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## Preface

For the twenty-fourth year, the Research and Theory Division of the Association for Educational Communications and Technology (AECT) is sponsoring the publication of these Proceedings. This is *Volume #2 of the 24<sup>th</sup> Annual Proceedings of Selected Papers On the Practice of Educational Communications and Technology* Presented at The National Convention of the Association for Educational Communications and Technology held in Atlanta, GA. A limited quantity of these Proceedings were printed and sold. It is also available on microfiche through the Educational Resources Clearinghouse (ERIC) system.

This volume contains papers primarily dealing with instruction and training issues. Papers dealing with research and development are contained in the companion volume (24<sup>th</sup> Annual, Volume #1), which also contains over 60 papers.

**REFEREEING PROCESS:** Papers selected for presentation at the AECT Convention and included in these Proceedings were subjected to a reviewing process. All references to authorship were removed from proposals before they were submitted to referees for review. Approximately fifty percent of the manuscripts submitted for consideration were selected for presentation at the convention and for publication in these Proceedings. The papers contained in this document represent some of the most current thinking in educational communications and technology.

M. R. Simonson  
Editor

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# Relate@IU >>> [Share@IU](#): A New and Different Computer-Based Communications Paradigm

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## Abstract

*The purpose of this study was to examine problems with the current computer-based electronic communication systems and to initially test and revise a new and different paradigm for e-collaboration – Relate@IU. Understanding the concept of sending links to resources, rather than sending the resource itself, is at the core of how Relate@IU differs from the traditional communications models. Instructional Systems Technology faculty and students were invited to participate in focus group sessions, where they were presented with an initial prototype of Relate@IU.*

*Our findings from the focus group sessions indicated that the current electronic communication systems are meeting user needs, while generating new needs that currently are not being met. This report reveals these newly generated needs stemming from the problems with current electronic communication systems. Relate@IU is intended to solve many of these emerging problems.*

*Following the initial testing of the Relate@IU prototype, we developed an updated computerized version of Relate@IU, named Share@IU. We are currently developing PHP scripts which will be tested on a small scale.*

## Introduction

Technology utilization in higher education has been witness to a dramatic increase in recent years. Two main areas of increase have been in electronic mail (Email), and Web technologies. “Three-fifths (59.3 percent) of all college courses now utilize electronic mail, up from 54.0 percent in 1999, 44.0 percent in 1998 and 20.1 percent in 1995. Similarly, two-fifths (42.7 percent) of college courses now use Web resources as a component of the syllabus, up from 10.9 in 1995, 33.1 percent in 1998 and 38.9 percent in 1999. Almost a third (30.7 percent) of all college courses have a Web page, compared to 28.1 percent in 1999, 22.5 percent in 1998 and 9.2 percent in 1999” (The Campus Computing Project).

Well-known problems exist with e-mail and asynchronous conferencing systems. Many people get flooded with e-mail messages they do not want in their inboxes (“e-mail assault” or “Spam”). Negotiation in advance between a sender and a recipient to agree to communicate is not allowed under the current e-mail paradigm; e-mail filters are often marginally effective. Furthermore, if one sends a large attachment to a group, then a copy of the attachment is delivered to each recipient’s inbox and may cause inbox quota overflows as well as network congestion.

While we have seen a dramatic increase in the utilization of communication technologies, there has been a distinct absence of new communication paradigms to match the current needs of users. Current literature suggests that “...communication may be a more important use and determinant of participants’ commitment to the Internet than is information acquisition and entertainment” (Kraut, Mukhopadhyay, Szczpula, Kiesler, and Scherlis, 1998). Problems still reside with the current electronic communication systems and a better paradigm needs to be considered.

## Literature Review

### Computer-Based Communication Systems



Computer-based communication systems require three basic components: hardware, software, and telecommunication lines (Harasim, Hiltz, Teles, & Turoff, 1995). Hardware components include a personal computer or workstation and an Internet connection. A Second component is the software used for group interaction (e.g., bulletin boards, electronic mail, and computer conferencing system). Lastly, telecommunication lines are needed to link the computers to groups of people to communicate and learn together.

### **Problems with the Current Computer-Based Communication Systems**

E-mail. An E-mail system is an electronic data transfer tool to exchange messages over networks. Most E-mail systems have capabilities for attaching files to messages to facilitate the exchange of large amounts of information (Harasim et al., 1995). The distributive nature of E-mail has led to some of the current problems being experienced by users. One such example of this is the phenomenon of attachments. Graphical E-mail applications such as Microsoft Outlook and Eudora allow for documents to be attached to an E-mail message with ease. This attached document, however, has the potential to spread information, or a virus, with extreme speed. Also, the file size of attached documents is large relative to a normal E-mail message. This large size can lead to an over-quota status of the recipients E-mail account. When such accounts are over-quota, other electronic messages cannot be delivered. There are numerous other examples of the problems users face every day with E-mail which will not be discussed here.

Computer collaboration systems. According to Harasim et al (1995), computer collaboration systems allow joint collaboration in a method other than exchanging isolated pieces of information (i.e. Email attachments). It provides groups with specific spaces inside the software that can be tailored to their needs. Each group communication space has access privileges set by the person who creates the space. Each collaboration space provides lists that allow participants to tell who has accessed what material. Changes on earlier contributions and notifications of changes are also possible. Contrary to such strengths, however, computer collaboration systems have some weaknesses. The most common difficulty is technical problems: people do not know how to use collaboration systems. They are lost in a system, fail to edit online, and have difficulties uploading and downloading documents (Harasim et al., 1995). These problems relate to the specifics of the collaboration system or the interface between the hardware and software – there are various types and versions of collaboration systems. Another problem is communication anxiety, which comes from lack of immediate or appropriate responses within a reasonable time. This is especially true for asynchronous environments where immediate interactions are not possible. People also have difficulties managing increased information flows. With networking and increased access to education and information, the key challenge becomes learning how to manage the information overflows.

### **Transformation to Peer-to-Peer Computing**

Peer-to-Peer computing provides individual users with direct connections to desktop computers for communicating. This is in contrast to the more familiar centralized model of computing used for broadcasting information and electronic commerce. In the following passage, Lewis (2000) describes the transformation from a centralized model of computing to a peer-to-peer model.

“The Internet transformed the world by linking computer networks. The World Wide Web transformed the Internet by making it easy to link files on those computers. Now another major transformation is occurring. By enabling millions of computer users to search for files and transfer them from one desktop computer to another, instead of the current model in which files are typically stored on and retrieved from a central Internet computer called a server, the balance of power shifts from the commercial interests that now dominate the Internet to the individual.” (Lewis, 2000)

Since the spring of 2000, peer-to-peer computing has been gaining momentum in the business community. This spur in momentum is largely due the growing popularity of Napster, the music exchange service. One company who has been leading the way with peer computing innovations is Groove Networks. They have developed an Internet communications software program called Groove, which allows people with shared interests to make direct connections for real-time interaction. According to the company, “Groove moves beyond the World Wide Web paradigm, leveraging the two-way capabilities of the Internet to provide a peer computing platform for use by individuals and small groups, in both a business and personal context.”

According to Groove Networks, peer computing innovations have come in three different flavors: Direct access to information, Direct access to computing power and Direct access to people. At the core of these three peer-to-peer innovations is the type of ACCESS we as individuals require/enjoy. Peer-to-Peer computing places the user in control. It is clearly a user-centered approach to computing. People are attracted to peer computing for (a)

creating a shared context among a group, (b) having the flexibility to add functions on an as needed basis, and (c) making connections without having to go through a centralized resource. These reasons naturally combine to allow people to gather together to make informed decisions quickly.

### **Purpose of the Study**

The purpose of this study is to examine major problems and needs with the current computer-based communication systems and to initially test and revise a new and different paradigm for e-collaboration – Relate@IU.

### **Research Questions**

This research focused on two sets of questions. The first set focused on the general use of the current electronic communication systems. The second set focused on the capabilities of Relate@IU. The general questions were: (a) How are you using electronic communications technologies? (b) What major problems have you encountered with electronic communications technologies? (c) What types of improvements would you like to see in the future? (d) If you could dream of a system, any system, that could make your communication life simpler, what would it look like? and (e) Do you feel that current online collaboration tools are meeting your needs? The specific questions related to Relate@IU were: (a) Are there any aspects of the prototype that still need clarification? (b) What problems do you see with the current state of the prototype? (c) What critical characteristics of online collaboration are missing from the prototype that you would like to see included? and (d) How would you improve the interface?

### **Methodology**

#### **Relate@IU**

Relate@IU is not the same as e-mail, the Web, or asynchronous conferencing as typically implemented. It is a new e-collaboration tool that is distinguished from the current computer-based electronic communication system.

*Table 1. Current Computer-Based Communication Systems vs. [Relate@IU](#)*

	Current Systems		Relate@IU
	E-mail	Collaboration Tool	
Relationship	Not negotiated	Negotiated	Negotiated
Location of Files	Multiple E-mail Servers	Shared Server	My Web Space
Ownership Item	Creator & Recipients Message, File & Link	Creator & Recipients Message, File, & Link	Creator Subject Line & Link
Exchanged Number of Copies	Number of recipients	One	One

**Negotiation of relationships.** With the current computer-based electronic communication systems, relationships are not negotiated. With e-mail addresses, anyone can send another person as much information or as many files as they like. Regarding unwanted e-mails, people spend several hours a week just deleting them. No control exists between a sender and a recipient, and it makes people suffer from such problems as “e-mail assault”, over-quota in the recipients’ e-mail inboxes, etc. In order to increase effective and efficient use of electronic communication systems, selective information needs to be exchanged with selective people. With the new system, it is envisioned that negotiation must occur among people who agree to collaborate.

**File linking system.** With our current electronic communication systems, we send out messages, files, or links. Besides unwanted e-mails, what slows down swift communication is the exchange of large files. Under the current e-mail systems, files are sent out as attachments. If modification is needed after a file is sent out, a different version of file is sent out. If modifications are made frequently, outdated files pile up in the recipient’s mailbox until the recipient deletes them; this can cause the mailbox to reach its quota and in worst case, new e-mail messages are rejected by the system. Under the new system, people never send out files; what is sent to others in the collaborating

group is a link to the owner's file. The new system is a file linking system, and the access to the file is restricted exclusively to the collaborating group.

One file in one place – control on ownership. With the current electronic communication system, exchanged files reside in e-mail servers or, in the shared server of an electronic collaboration system. In order to distribute a file to multiple individuals, essentially the initiator is making multiple copies of that file. Under [Relate@IU](#), every person saves his own files on his Web space and can exercise controls on the relationships with people in terms of accesses to the files: read-only or modification-enabled. Files are never sent out and remain property in possession of the owner, and people are given permission to view and/or modify the files. However, once another person is viewing a file, he or she normally cannot be prevented from saving it on his/her own storage device (i.e., cannot be prevented from making a duplicate copy).

## **Design Prototype**

The researchers held a brainstorming session to begin to conceptualize the fundamental principles of the new electronic communications system, [Relate@IU](#). One of the important products of our brainstorming session was a comparison table highlighting the key conceptual differences between the current electronic communications systems and the [Relate@IU](#) system (see Table 1). Also, sketches of the initial prototype and development notes were developed during the brainstorming session. From these sketches, we were able to design an initial prototype to present during our focus group sessions.

Fortunately, our focus group audience understood the nature of rapid prototyping, and that this initial prototype, although presented in an electronic form (Microsoft PowerPoint), was just the first of many iterations.

Configurations of current electronic mail (e-mail) systems drove the development of the [Relate@IU](#) prototype. Current e-mail systems can organize messages in ascending or descending order by when the message was received, who sent the message, if the message was red flagged (used to note high importance), or if the message contains an attachment. Beyond this, users also have the ability to sort their messages into sub-folders. This organizational structure was also incorporated into the [Relate@IU](#) prototype. Our prototype presents users with sub-folders that represent each relationship they belong to. From this point, requests are presented in the order that they were received; however, they could be re-organized in ascending or descending order by action requested (read or review), subject, file location, or date received.

At this point, a functional overview of the current prototype may be beneficial. To start, a user would open their [Relate@IU](#) web page, and then be prompted to log into the system. The next screen to be displayed would have a list of current relationships on the left, a toolbar to create relationships and send requests at the top, and the main information display window located to the right of the relationships list. The main information display area contains two types of information, requests that individuals or groups have made to you, and your requests to individuals or groups. The content that is displayed in this area is controlled by your selection of an existing relationship from the relationships list on the left of the screen. The tool menu at the top of the screen also affects the relationship that has been selected from the relationships list on the left side of the screen.

Forming relationships can be done at any time by selecting the "Create / Modify Relationship" tool. A pop-up window appears and allows the user to enter a title of the relationship, who is involved in the relationship, and what privileges they have at the folder level (read only or modify).

The [Relate@IU](#) system differs from the traditional e-mail system in the fact that it does not send an actual message. This new system sends a subject line and a link to a file. This file could be anything from a word processing document, to a digital image, to an audio file.

Understanding the concept of sending links to resources, in place of sending the resource is at the core of how [Relate@IU](#) differs from the traditional communications models. In order to facilitate our focus group participants understanding of this concept, we first asked them a series of questions designed to have them think about their experiences with current electronic communications systems.

Next, we presented a comparison table highlighting the key conceptual differences between the current communications systems and the [Relate@IU](#) system. At this point, we showed the focus group participants our prototype, and talked through a scenario of how the tool would be used.

## **The Focus Group Interview**

We used focus groups as a primary method of data collection in order to stimulate new ideas, creative concepts, diagnose potential problems and to generate impressions of our new electronic communications system, [Relate@IU](#). We conducted three separate focus group interviews. Two of these sessions were student focus

groups, and the third session was a faculty focus group. We collected the data during the focus groups by video taping the sessions. Stewart and Shamdasani (1990) recommend ordering the guiding questions from general to more specific. An agenda containing guiding questions for the focus group sessions was designed by the researchers to guide the flow of the discussion. Each participant was provided with a copy of the agenda. The researchers decided to conduct the focus group sessions prior to the one on one interviews in order to solve initial conceptual problems with the prototype. In addition, the researchers wanted to gather data that would aid in improving the interface of the prototype, prior to presenting it in a one on one interview situation. According to Morgan (1997) "...follow-up interviews can help provide depth and detail on topics that were only broadly discussed in group interviews." Focus groups are a somewhat informal technique that can help assess user needs and feelings both before interface design and long after implementation (Nielsen, 1997).

## **Research Site**

Participants for this study were drawn from the Indiana University Bloomington (IUB) campus, and more specifically the Instructional Systems Technology Department (IST). The IST Department is located within the School of Education. We conducted our focus group sessions in the main IST classroom.

## **Research Participants**

A purposeful sampling approach was used in this study in order to maximize variation among the research participants. Purposeful sampling is used as a strategy when one wants to learn something and come to understand something about certain select cases without needing to generalize to all such cases (Patton, 1980). Each participant was contacted via e-mail, informed of the purpose of the study, and was asked to participate. In particular, we were interested in selecting a variety of IST masters and doctoral students, early or late in their program, spoke English as a first or second language and were male or female. In addition, we were also interested in selecting IST faculty.

Study participants include three masters, four doctoral, and three faculty. Among the students, three were male and four were female, and among the faculty, one was a female and two were male. All except for two participants spoke English as a first language.

## **Results**

### **General Questions**

Below are the general questions from the focus group interview, followed by key points that were raised.

#### **1. How are you using electronic communication technologies?**

All participants indicated that they utilized SiteScape Forum (SSF) for document sharing with classes. E-mail was also used by all participants for academic and personal communications. One participant stated that File Transfer Protocol (FTP) was still utilized for posting documents to a server space. Most participants stated that they utilized online search engines to locate information and updates on the World Wide Web (WWW).

#### **2. What major problems have you encountered with electronic communications technologies?**

A majority of participants reported problems with a lack of system interoperability (e.g. MS Word and WordPerfect, Macintosh and PC platforms). This was mirrored by a large number of participants reporting difficulties in moving a document from one system to another.

Electronic mail was another source of difficulties for our participants. Few reported problems with junk mail (Spam), about half reported difficulty with reading attachments (associated with the PINE e-mail system). Quickly reaching the maximum quota (file storage allotment) was also of concern to about half of our participants. A few participants commented about the difficulty in replying to challenging e-mails, stating that they don't know how to answer or what to do with the message.

When dealing with multiple communications systems, a majority of participants had commented on the tedium of logging in to multiple forums, specifically with SSF, and then having to remember not only multiple passwords, but also which forum to access. A few participants had difficulty with the unintuitive interface with SSF. Our faculty focus group noted that there is no integration between the various commonly used communications systems such as SSF and e-mail. SSF server downtime was noted by a just under half of our participants as a major source of difficulty.

3/4. What would your dream system look like?

Although we did receive a range of responses to this question, there was no one feature that was repeated with a high frequency. Almost half of the participants had indicated that they wished to have greater control of how, and with whom, they collaborate. One third of the participants would like to see human-like intelligence with advanced filtering, prioritizing, and automatic archiving of electronic mail and data. The ability to customize the system, and visual communications were both mentioned by one fifth of our participants. There were a number of responses that were unique. These suggestions ranged from a seamless integration of the most commonly utilized systems, to having a system be able to recognize what type of file is being used, to a tracking and check-in / check-out system for working with documents in an online collaborative file sharing environment. One common dream was that of unlimited storage space

5. Do you feel the current system is meeting your needs?

Half of all participants responded that yes, the current communications systems are meeting their needs. However, there were a number of conditions that were placed on this response. One condition was that collaboration at a distance works with a relatively small number of people. Another condition is that the current technology is forcing users to follow specific rules, in other words users are submissive to the technology. One participant stated that due to limited experience with electronic collaboration, that they were uncertain as to what there needs were, and therefore was uncertain if the current systems were meeting those needs. Another participant was not satisfied with the inadequacies in the discussion type tools, particularly for students and classes. A few participants made the comment that current online collaboration tools are meeting many of my needs and generating new needs that are not being met.

### Responses to the Prototype

Below are the focus group responses to the current Relate@IU prototype.

**Comment 1: If you send a link to 10 people, how do you know who read it if when one person reads it and it changes to non-bold?**

At the present time there is no understanding on our part as to how this tool could display which members of a group have opened the document, and who has not.

**Comment 2: Would it send you some sort of notification (if someone sends you a request to collaborate)?**

The current system was designed with the idea that it would be its own system, not tied into other IU systems. People would agree to work together via current methods, and then go to the Relate@IU tool to assist them in their collaboration. Relate@IU was not viewed as an initial step; however there is room for redesign.

**Comment 3: I'm thinking four people in a group, 3 classes, that's 12 individuals – do I want to set up 12 relationships?**

For three different groups you would have to form three different relationships. It is possible to have multiple individuals involved in one relationship. SiteScape Forum (SSF) might be a more appropriate tool for collaboration in cases similar to this.

**Comment 4: So this wouldn't be for sharing documents with a group, I would share my stuff, but it's not a place where the group has...**

A group of individuals may have access to read or modify documents that currently exist in your web space; however, the current design of the system does not allow users to place a file in another user's space. One member of a group can send a link to the file, and other members of the group can access the file, but there is no central repository for the group to store documents.

**Comment 5: (A) Problem would be that there is no identification of who is sending a request when multiple people belong to a group (i.e. project team)**

Currently, the system recognizes users as either an individual user, or as one user accessing an account that has multiple users. The system can be redesigned to utilize usernames to identify the individual who sent the request, as well as to identify which users have accessed documents.

**Comment 6: All most everyone I know I have multiple types of relationships with, how would I manage that?**

**Comment 7: What I'm seeing is that the relationships are all about document sharing.**

**Relate Becomes Share@IU**

A paper prototype was built to simulate the functions that were determined in the Relate@IU research study. Usability tests were conducted with this paper prototype. Some problems were found with the paper prototype and users suggested some changes to this prototype. Due to the nature of this study, we were open to ideas and suggestions of the users. Furthermore with the considerations of these problems and suggestions, two more computer prototypes were developed and further usability tests were done. During this development stage, we were determined to develop a user-friendly system. If this new system is seen as a new tool to learn or require training, people might resist using it. We wanted to make sure that it was usable by various types of computer users and we tested this with a wide variety of users.

When we started to mock up Share@IU, we identified the critical functions required for the system. We recognized that there were fundamentally three different categories of functions: File management, communication and group functions. We identified the sub functions under these categories. The File Management system is similar to Windows Explorer or generic FTP programs. We developed a similar interface for the File Management System part of Share@IU. Communication and group level functions were added to this interface.

In the File Management Functions, the user (owner of Share@IU space) can create a folder, upload files, determine where s/he is working, navigate between folders (up a level or down to subfolders), and determine the files in the folder with their size and modification date. In the Group Functions, the user can determine who can have access to that specific folder. In the Communication Functions, the user can send a message to the group about the uploaded files (see Figure 1).

In the following figures, some shots of the electronic prototype of Share@IU are shown. This is the view of a Share@IU owner. If the user sends a message to his/her group, they don't see the files in this way they just follow the link, and can see what is allowed for him/her.

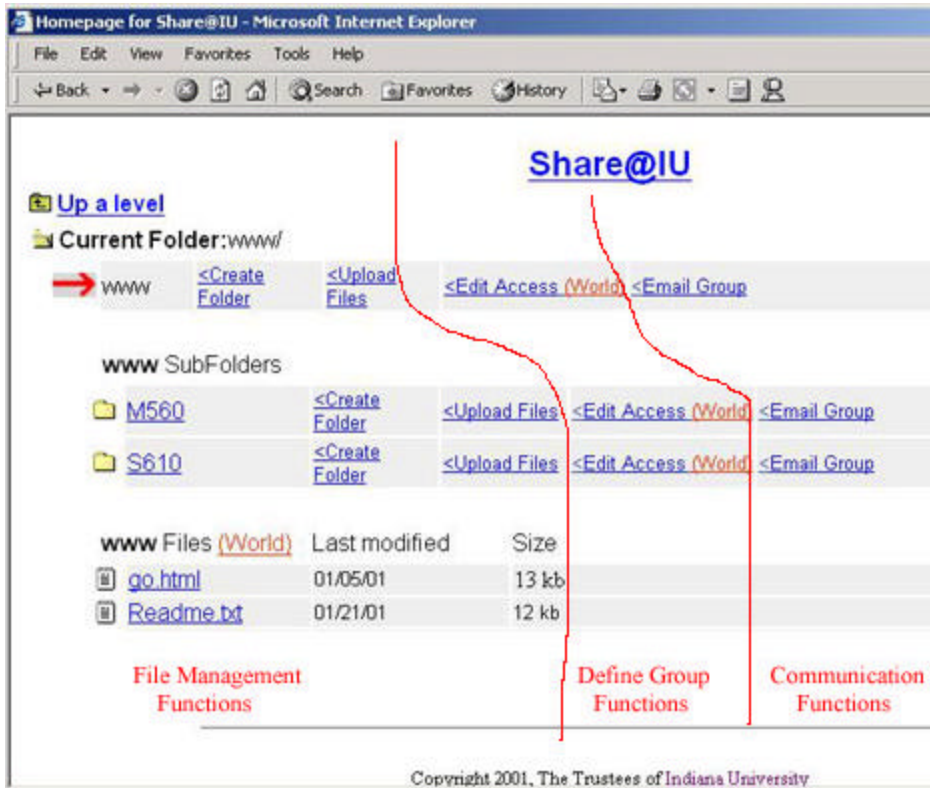


Figure 1: Share@IU Computer Prototype: General View (Separator lines are superimposed here, but not seen by user)



Figure 2: Share@IU Computer Prototype: Choosing a GroupType

The user determines his/her folder access level. S/he can choose either of these options and accordingly sets the folder accessibility to the defined group (see Figure 2).

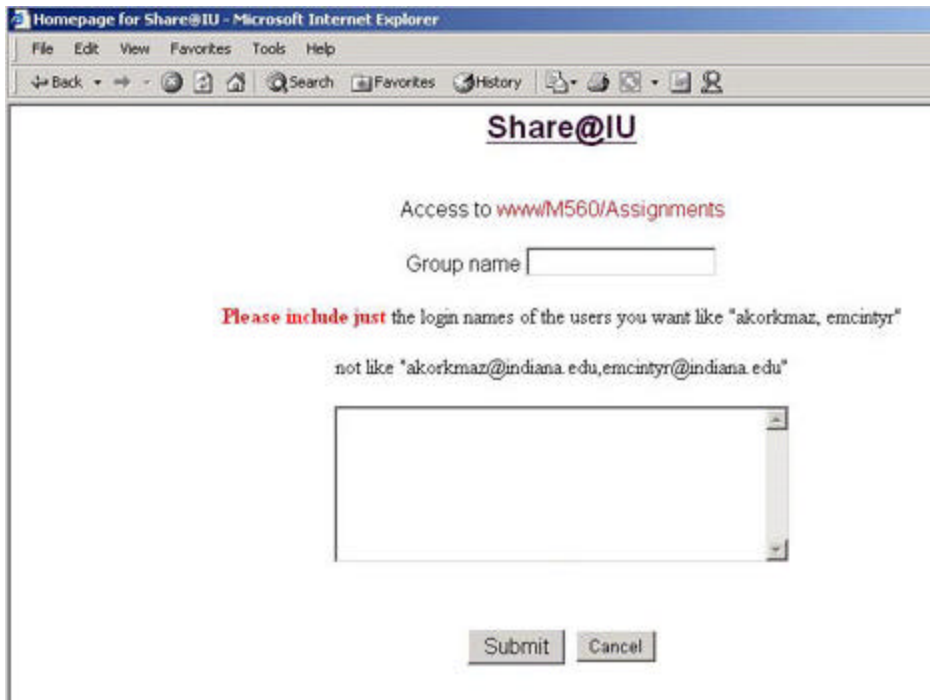


Figure3: Share@IU Computer Prototype: Creating Own Group

If the user wants to determine specific users, s/he can choose “create my own group” option (see Figure 2) and determine the user ids and add them to the list (see Figure 3).

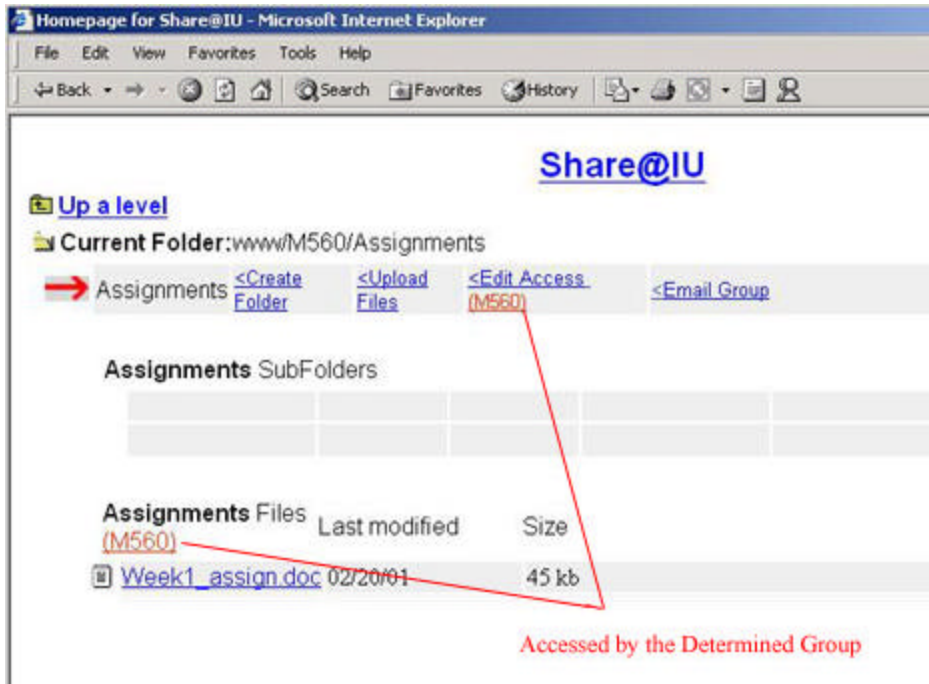


Figure4: Share@IU Computer Prototype: After Group Access Changes

After user determines the accessibility of the folder, the folder’s accessibility level changes and files and folders in that folder change automatically (see Figure 4).

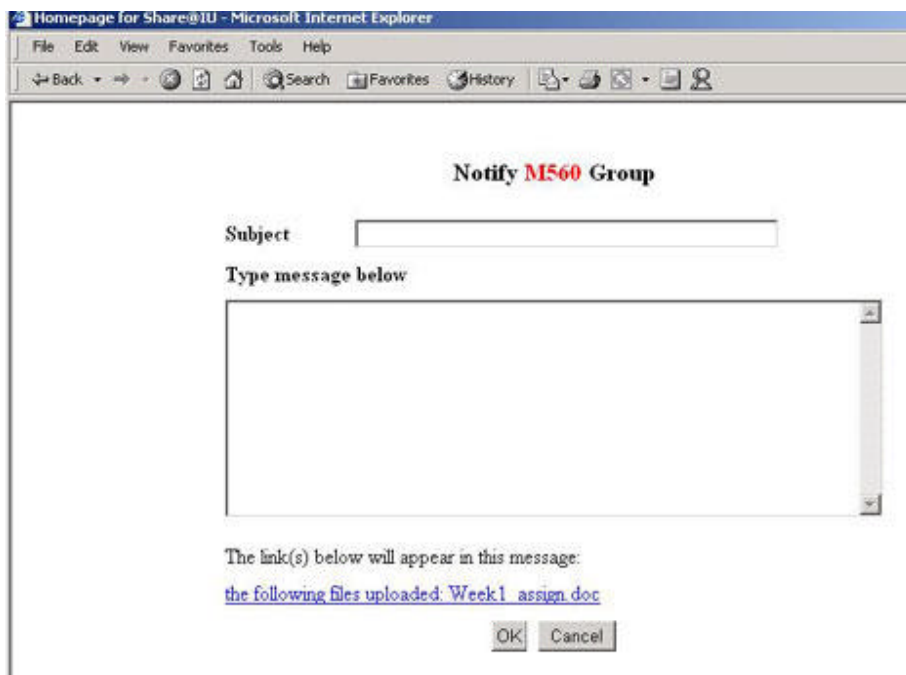


Figure 5: Share@IU Computer Prototype: Group Notification of the Uploaded Files

If the user wants to inform the group about the uploaded files, s/he can send a message by clicking on “E-mail group” option (see Figure 4). They can add a message and subject for their e-mail (see Figure 5)

### Limitations and Future Plans



Due to purposive sampling in the initial qualitative study, generalizability of findings beyond the specific group investigated is not warranted. The results were nonetheless useful in shaping the direction of subsequent prototypes, and further usability testing of those prototypes helped to improve their design.

[Share@IU](#) is still a prototype (simulation) that has not yet been implemented as a working product. As we develop a functioning product, additional usability tests will be conducted to refine the design. It is our hope that [Share@IU](#) can be implemented on a variety of operating systems (e.g., Unix, Linux, MS Windows, Macintosh) running standard Web servers (e.g., Apache, IIS). Scripts will be written in PHP, which will run as CGI applications on the server side. Users will be able to access [Share@IU](#) through standard Web browsers (e.g., Netscape, Explorer, AOL, Opera) with normal Internet connections (PPP), and read messages generated by [Share@IU](#) with any standard e-mail system (e.g., Eudora, Outlook, Messenger).

## References

Campus Computing (2000, October). The 2000 national survey of information technology in US higher education: Struggling with IT staffing. Retrieved December 8, 2000, from the World Wide Web:

<http://www.campuscomputing.net/pdf/2000-CCP.pdf>

Harasim, L., Hiltz, S. R., Teles, L., & Turoff, M. (1995). Learning networks: A field guide to teaching and learning online. Cambridge, Massachusetts: MIT Press.

Kraut, R., Mukhopadhyay, T., Szczypula, J., Kiesler, S., & Scherlis, W. (1998). Communication and information: Alternative uses of the internet in households. Conference on Human Factors in Computing Systems, 1, 368-375.

Lewis, P. H. (2000, June 29). Napster Rocks The Web. Retrieved December 7, 2000, from the World Wide Web: <http://www.nytimes.com> New York Times, Technology – Circuit

Morgan, D. L. (1997). Focus groups as qualitative research. (2nd ed.). Thousand Oaks, CA: Sage.

Nielsen, J. (1997). The use and misuse of focus groups. IEEE Software, 14(1), 94-95. Retrieved November 26, 2000, from the World Wide Web: <http://www.useit.com/papers/focusgroups.html>

Patton, M.Q. (1980). Qualitative evaluation methods. Beverly Hills, CA: Sage

Stewart, D.W., & Shamdasani, P.N. (1990). Focus groups: Theory and practice. London: Sage

# **Collaborative Cultural Studies over the Internet; Learning cultures with virtual partners. A Project between Baylor University and Tokyo Institute of Polytechnics**

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## **Introduction**

“Culture is a complex, abstract, and pervasive matrix of social elements that functions as an all-encompassing form of pattern for living by laying out a predictable world in which an individual is firmly oriented.”

Richard Porter & Larry Samover

Offering a predictable world and orienting students in that controlled environment offer the faculty a new level of challenge. Technology makes this task possible. The ultimate goal of this project challenges us to create and provide a communicative environment in which is most natural to L2 and C2<sup>1</sup>. We seek to teach in the world where the instructors and students coexist in non-artificial simulation.

The computer-assisted classroom is no longer a simulation, but a real life. The idea of “Learning can be undertaken in state-of-the-art classrooms, but can also be integrated into the living arrangements” (Gilman) is obsolete. In 21<sup>st</sup> century life, our lives globally connect to each other with technological network. The networked life is the living life. In that environment, one of the most important issues is the understanding of L2 and C2 to make successful communications.

Since the fall semester of 1995, students at Baylor University taking Japanese and students at Tokyo Institute of Polytechnics have had opportunities to communicate each other and learn together at in a real-world situation. Until the fall 2000, the format limited them to e-mail communication. Today, we have begun a new adventure in learning culture and communicating appropriately with the colleagues from the other side of this planet using other Internet tools.

## **Software and Hardware Used**

Communication software, iVisit, utilizing web-based camera provides an instant visual, oral, and aural transoceanic communication along with text chat. This method brings a classroom halfway across the globe next door. We use this web-based free-of-charge software in the introductory and concluding discussions. Due to our hardware limitation, each school used one web-based camera.

FirstClass offers students to communicate in the manner of a bulletin board service. It allows students to leave messages, possibly enhanced with graphical and audio files, anytime of the day from anywhere in the world. It allows students to read the postings and share ideas. Contrary to iVisit, FirstClass gives time to students to think and examine what to post. The client software is free-of-charge and supports many different platforms and languages.

## **Criteria**

For this study, Baylor University selected the parameter range of students to be 3<sup>rd</sup> semester, 150 contact hours, or higher. Tokyo Institute of Polytechnics has selected students from Intercultural Communication Studies who have been studying English for at least 6 years. Students from both universities interacted in L1 and L2 to complete the task.

## **The Project Time Table**

### **Introductory iVisit session**

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<sup>1</sup> L1 is the first language and L2 is the second language. C1 is the culture of the students’ own, and C2 is the culture which student is learning as the second culture.

At the end of September 2000, the first iVisit session took place. Baylor class met at 7p.m. to accommodate the time difference of 14 hours. Students answered Pre-Project questionnaires to examine what technological and cultural experiences they have had and how those experiences will change them at the completion of the project.

During this one-hour introductory session, instructors shared the intention and schedule of the project first. Then many students took the opportunity to introduce themselves and asked some questions such as weather, fashion fads, popular music, politics, and other current events. Some questions were prepared and others were spontaneous.

### **Research in C1**

The myth exists among Japanese that folks in Texas still use horses as the main transportation and chases and feeds livestock all day. Then there is a myth among people in the U.S. that Japanese still walk around with katana swords in their sash and drink sake with geisha girls. Although such misunderstanding exists, students have very shallow understanding of their own culture to help others understand the truth. Therefore, in 2000, we assigned students to research in C1 to deepen their knowledge before learning C2 any further. Japanese students took the subject of bushi/samurai while U.S. students researched all about cowboys.

Due to the great number of students involved in this project, the students were divided into six groups; history, jobs, appearances, life style, culture, and beliefs and spirits. By mid October 2000, students posted their research results in assigned rooms on FirstClass server in Tokyo. We chose students to post their messages of C1 in L1.

### **Read in L2 and learn C2, then post replies in text and video**

Students read the posted messages in L2 and learn C2. Then they are required to post a response, including a question, in the mixture of L1 and L2 by the end of October 2000. The interface of FirstClass is very similar to that of many popular email applications. However, the messages are threaded for better organization. In 2001, we added another method of communication using video letters. Two streaming servers, a Quick Time server at Tokyo Institute of Polytechnics and a Real server at Baylor, hosted this project.

### **Read and post in the mixture of L1 and L2**

By middle of November 2000, students have read the comments and questions toward their research. These comments and questions required further research in C1. By this time the communications are getting less formal. Students are developing healthy friendship within their small groups. We encourage students to correspond as much as they prefer.

### **Concluding iVisit session**

At the beginning of December 2000, we conducted a farewell iVisit session. Students from U.S. met at 6 p.m. to accommodate the time difference. (A cultural lesson, meeting time in U.S. changes by one hour, since there is no Daylight Saving Time in Japan.) The excitements filled the both rooms to meet their cyber friends from their small groups and finally put the name and face together. Students answered the Post-Project questionnaires consisting 44 questions, to complete this project.

### **Five C's**

“Culture is not the people but the communication that links them together.”

Mary Jane Collier

Our goal is to see how students can learn C2 through their communication in more realistic way through technology. In order to complete this approach, we must consider and examine the Five C's and apply this idea to enhance learning.

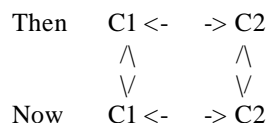
In the first C, *communication*, we use iVisit to encourage and enhance students' speaking and listening skills. In contrast, during FirstClass sessions students applied mainly their reading and writing skills. Many students enhanced their FirstClass presentation with visual and aural communication tools, such as sound and graphic files to deepen the communication.

As mentioned earlier, this project is not only learning C2, but begins from examining C1. This enables the complete reflection and learning of *cultures*. Examining and understanding oneself only enhances understanding others. FirstClass sessions allowed students to examine the myth and find the truth. iVisit sessions filled students' appetite with better understanding of contemporary popular culture.

As students learn another culture in a language class, there is an opportunity to make *connections* to other academic fields. The following chart indicates some of what students had shared and learned throughout the project.

	iVisit	FirstClass
Politics	Discussion of contemporary agenda	Political system from the appropriate era.
History	N/A	Cowboys and Samurai
Music	Discussion on contemporary music	Music that cowboys and samurai listened.
Art	Contemporary fashion fads.	Paintings depicting the appropriate era were shared.
Literature	N/A	Appropriate literatures were shared.
Sociology	Experiencing such traits as tardiness and shyness of students make a reflection to its culture.	Fashion, jobs and other related issues were discussed.

From entire project students received opportunities to make *comparisons*. One way is to compare and contrast now and then. It is done in different subject fields, which we discussed previously as a part of connection. Comparison of C1 and C2 within the particular time occurs concurrently. These comparisons take place during both iVisit and FirstClass sessions.



To provide *Communities*, we used iVisit for its visual, oral, and aural communications. This community was a large community where students shared one camera, one microphone and one screen. FirstClass clients were more intimate. It used small groups for the reading and writing communities. Individual involvement became more crucial in this exercise. Yet we realize that a true global community evolves during the project. Both software can be used from anywhere in the world.

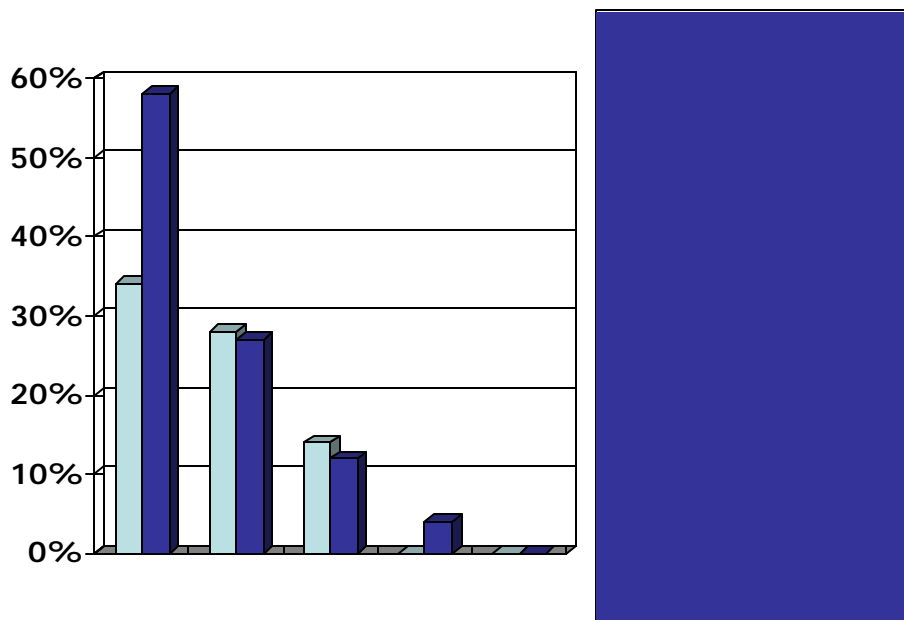
These five c's take significant part of this project. Each c depends on each other to make this collaboration effective. Only when these five c's become interactive, this project claims success.

#### Data

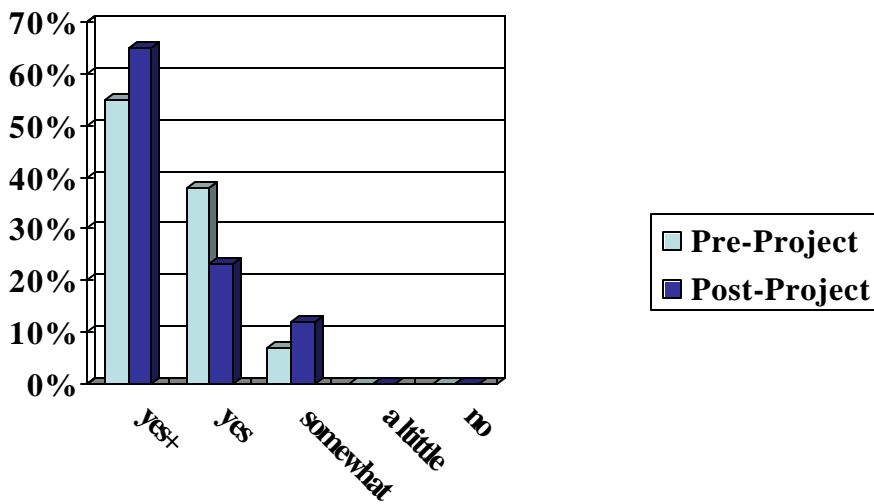
Since the first semester, all of the targeted Baylor students have already been assisted on their language acquisition by computers from their "E-mail Pen pal" programs. However, their change in opinion and attitude toward computer-assisted-learning has not yet been measured until now. Students have and will complete two questionnaires for this collaboration. One must be taken before the project and the other immediately after completion of the project.<sup>2</sup>

Although current result limits in accuracy to determine its outcome from the data of only one project, preliminary data result from Baylor students shows the effectiveness of computer-assisted acquisition. In asking, "Do you think computer is a useful learning tool in academic setting?" clearly there is an increase in recognizing the usefulness and effectiveness in application of technology in education during one semester.

<sup>2</sup> Questionnaires are available for the viewing purpose only at <http://www.baylor.edu/~Japanese/interculture.html>.



Another interesting question asked, “Are you interested in foreign cultures?” The interest in foreign cultures increased after experiencing this collaborative project. Therefore, as predicted, the technologically enhance culture-learning collaboration place learners in positive and predictable communicative world in which learners must experience to acquire another culture.



On the Japanese side, the questionnaire results show no statistically significant change of attitudes among students. However, quite a few post project comments from these Japanese students tell that they became able to perceive their virtual partners as real persons and build a kind of relationship that promotes learning. The

importance of personal relationship for network-based learning programs has been suggested by several Japanese researchers, and this study meets such a claim.<sup>3</sup>

### Problems to be solved

As with any project, we can expect some problems. The problem, which we cannot resolve, is the time difference during iVisit sessions. 14 or 15 hours in time difference, depends on the Daylight Savings Time, becomes a menace. Another problem in iVisit session is the poor connection speed. The poor connection speed will result in jerky and dropped video and audio feed. Another result of the poor connection speed is the extreme reverberation of audio feed which disables the recognition of the language.

Limitation in the number of video windows forces us to use only one camera. It would be ideal to have all 30+ students to appear in individual windows. But software issue and connection speed limits us to perform at that level yet.

In FirstClass neither the time nor connection speed raise serious concern. The limitation in number of students who can login simultaneously brings a serious concern. This problem disables to login to FirstClass server as an individual during a class and has discussion on particular postings.

### Conclusion

After all, “when we are merely being ourselves, acting according to our deepest instincts, human being reveal fundamental differences in what we all tend to think of as normal behavior.” (Storti) Communication errors easily and rapidly occur in our networked life. Strangers from all over the world gather in the online community. Without proper understanding of cultures, the behavior progress inappropriately.

Five c’s take an important role in teaching culture in foreign language courses. In the acquisition of language and culture, the technology assists teachers to offer innovative and effective method of educating. Technology aids *communication*, assists to learn *culture* of L2, make *connections* with speakers of the target language, provides *comparisons* between L1-L2 and C1-C2, and offers to participate in *communities* using languages other than L1.

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<sup>3</sup> The importance of relationship building for network-based corroborative learning is discussed in the following books and the article.

Saeki, Y., Fujita, H., and Sato, M. eds. (1996), *Manabiau Kyoudoutai* (The Community for Learning Corroboratory), Tokyo: University of Tokyo Press.

Mima, N. (1997). *Fushigikan Network no Kodomotachi* (Children of Fushigikan Network), Tokyo: Just System

Okubo, M (2000), “Learn and Express through the Internet” Proceedings of the Sixth Joint Conference on Educational Technology, pp. 873-874. : JCET 2000, Naruto, Tokushima, JAPAN.

**Reference:**

- Collier, Mary Jane. "Cultural Identity and Intercultural Communication" Intercultural Communication. New York: Wadsworth Publishing Company, 1996. 36-44
- FistClass - <http://www.softarc.com/>
- iVisit - <http://www.िवisit.com/>
- Porter, Richard & Larry Samover. "An Introduction to Intercultural Communication" Intercultural Communication. New York: Wadsworth Publishing Company, 1996. 5-26
- Rauch, Jonathan. The Out nation. Toronto: McGraw-Hill Ryerson, 1992
- Storti, Craig. Cross-Cultural dialogues. Yormouth: Intercultural Press, Inc., 1994
- Gilman, Sander L. "Learning a Foreign Language in a Monolingual World." Publication of the Modern Language Association of America 115 (2000): 1032-1040

## Comparing Different Genres of the Internet in Education

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### Abstract\*

*As technology improves, everyday new devices are developed in more sophisticated ways. This is also true for classroom and teaching tools. If technology is to be integrated into schools successfully, then teachers must understand that instructional technology is not just hardware or software, but rather a process and/or approach to teaching and learning. There are many benefits and barriers of using technology in teaching. First, with the use of technology the lesson can be adapted to accommodate special needs students. Technology helps the teacher individualize the lesson to meet all students' needs. Second, technology also helps make learning meaningful. Through the use of technology learning can be presented in a novel and creative way. When students take personal interest in a topic they begin to take ownership of their newly acquired knowledge. Even though the Internet has many benefits it also has weaknesses with the use of technology. This study is a review of different genres of online educational tools and aimed at elucidating the purposes benefits, and barriers of using different Internet genres.*

*(\*) An initial draft of this paper was submitted as a part of the requirements of the course, EME 5207: Designing Technology Rich Curricula, offered by Asst. Prof. Colleen Swain in the College of Education at The University of Florida in Spring 2001.*

### Envisioning Use of the Internet in the Classroom

The Internet has been introduced in schools for 15 years; however, it has only been a few years that educators see the power of the Internet in student learning and achievement. The Internet may play various make roles in education. It is the responsibility of the teacher to decide how to best use of the Internet Genres to support student learning. When teachers integrate the genres into their curriculum, they can enhance their lesson. The Internet genres give students access to real life situations, not text book cases. Students sense the difference and are more involved, their learning is more in-depth, because they are using their critical thinking skills, making judgments. This article mainly points benefits and impediments of the Internet Genres for educators. The Internet was originally designed to allocate information in an interactive way and to allow people to communicate with each other and with machines (Bernars-Lee, 1996). It hoped that the following framework sheds light on education in classroom.

Classifying and defining different aspects of the Internet Genres allows teachers to use technology to enhance students' learning, and to improve teaching. However, without an educator who facilitates learning, the richness of Internet in the classroom setting is not effective. March in his article "Working the Web for Education" compares traditional and web-based education (March, 2001).

There are many benefits and barriers of integrating technology in class. First, with the use of technology the lesson can be adapted to accommodate special needs students. Technology helps the teacher individualize the lesson to meet *all* students' needs. Technology also helps to make learning meaningful. Through the use of technology learning can be presented in a novel and creative way. When students take personal interest in a topic they begin to take ownership of their newly acquired knowledge.

Even though the Internet has many benefits, it also has weaknesses. It can be totally useless or less useful than traditional teaching when weaknesses are not understood. One disadvantage of using the web quest format, for example, is that students could get too wrapped up in serendipitous learning. While they could go to a site carefully chosen by the teacher, they can link to other material on that site or other sites that they find personally interesting.

In this article we are going to discuss the purposes, benefits, and barriers of using different Internet genres.

### WebQuest:

WebQuests include lesson plans developed and posted by teachers. The plans incorporate the use of the World Wide Web sites and allow for student interaction with the sites in order for them to solve problem and make decisions (March, 1998). [<http://www.ozline.com/webquests/intro>]. Students are given a scenario and specific tasks



to complete to solve a problem or finish a project. Webquests have most of the critical attributes of learning as define by Jonnassen (1997)

**Benefits:**

- Different perspectives
- Meaningful knowledge
- Promote higher-order thinking
- Afford students the opportunity to practice collaborative thinking and cooperative learning skills.
- Comparing and contrasting
- Motivational
- Student have role to play
- Interdisciplinary & enabling cognitive flexibility
- Involves interactive learning
- Gain more in-depth learning skills
- Teacher (easy format) and student (safe links) friendly

**Barriers:**

- Time consuming (too much to cover)
- Depends on the maintenance & speed of the network
- Students' adaptation problems
- It might be hard to understand

**Online Lesson**

Online lesson is a continuous portion of teaching given to a certain number of learners over the Internet.

**Benefits:**

- Provides access to knowledge that learners need whenever they need them.
- Makes learners more independent and self-responsible.
- Easy to access
- Video and audio formats can add into lesson
- Accommodates multi-modal learners
- Enables individual pace
- Easy to update information
- Economical
- Easy to access
- Easy to print presented information.
- Students can construct their knowledge without instructor

**Barriers**

- Affected by slow and crashing networks
- Need backup plan if not accessible
- Decreases student teacher communication and interaction
- Need content and format preparation
- Motivational factors are not enough
- It is not easy to control learners
- Students can feel lost

**Tutorials**

- Tutorial is a period of online instruction given by teacher to the learners.

### **Benefits**

- Flexible. It can take place 24 hours a day at learner's convenience.
- Learner can access from any location with the Internet access.
- Economical
- Easy to follow program
- Very easy to present
- Easy to respond questions
- Experiment

### **Barriers**

- Rigid-fixed for one type of learner
- Teacher can not adapt individual
- So much scripted-text based

### **Simulation**

The *Oxford English Dictionary (online 2001)* gives the following definition for simulation: "The technique of imitating the behavior of some situation or process (whether economic, education, military, mechanical, etc.) by means of a suitably analogous situation or apparatus, especially for the purpose of study or personnel training". Simulation is intended to be discovery learning tool that allows the learner's freedom of exploration by giving learning environments without specific directions or explanations. Simulation occupies very important places in education (Lee, 1999). Simulations provide a unique environment for exploring new concepts, for gaining an understanding of the interplay between related complex phenomena, and for the construction of simplified working models of topics under study. Simulations are also one area in which computing technology is uniquely suited as the delivery mechanism for an educational experience.

### **Benefits**

- Helps students gain understanding
- Allows student to learn by doing
- No risk, no danger
- Rich economical experience, at anywhere, for doing anything
- Allows students to visualize abstract concepts
- Simplification of reference system
- Experience situation
- No consequences, freedom in exploration
- Enables higher-order thinking
- Creativity increases while possible negative reactions decrease
- Control more elements and better
- Mentally active gains
- Multidimensional mental representations
- Address variety of learning styles
- Novel experiences
- Provides a guiding context within which students can integrate what they learn.

### **Barriers**

- Can some times fake
- Not good for multiple uses-contextual
- Can expose violence
- Student imitate action in simulation in the real life -misgeneralization

- Repetition can be boring
- Within presentation mode pure simulation is of low level interaction

## **Games**

The *Oxford English Dictionary (online 2001)* gives a definition of game as below. Game is a diversion of nature of a contest, played according to rules, and displayed in the result of superiority either in skill, strength, or good fortune of the winner or winners.

### **Benefits**

- Has scores reinforcing
- Motivational
- Has fun
- Engaging
- No danger
- No consequences
- Enables higher-order thinking
- Offers big picture view leading to analysis and synthesis
- Communicate players instead of dialogue
- Explore problems and different perspective

### **Barriers**

- More fun than learning
- Time consuming
- Possibility of exposure to violence
- Less control over students
- Repetition may be boring

### **Telecollaborative: Interpersonal Exchange**

Telecollaborative/Interpersonal Exchanges are the structured activities in which students use the Internet tools such as e-mail, chat, and the world wide web to access, process, and share data and to communicate, and cooperate. Interpersonal Exchanges include: key pals, global classrooms, electronic appearances, telementoring, question-and-answer activities, and impersonations (Harris, 2001)

### **Benefits**

- Can talk to guest speakers
- Provides multiple perspectives
- Share ideas
- Connect to people outside of classroom around the world
- Bring expert to the classroom
- Generally free

### **Barriers**

- Requires background planning time, preparation takes time
- Needs equipment to practice
- Depend on network

### **Telecollaborative: Information Collection and Problem Solving**

Information Collection and Analysis are the activities that allow students to be involved in collecting, compiling, and comparing different types of information. Information Collection and Analysis activity structures include: information exchanges, database creation, electronic publishing, telefieldtrips, and pooled data analysis (Harris, 2001)

## Benefits

- Scientists and students can come together
- Collect data
- Share different data
- Gain access to information from experts
- Apply knowledge in real situation
- Promote higher-order thinking
- Analyze different views, evaluating information
- Includes learning activities

## Barriers

- Information is not always evaluated for accuracy, relevance, and currency
- Information may be too difficult or easy for students grade level
- Difficult to control
- Need technological tools
- Limited time, time consuming
- May not be appropriate student level and decide what kind of genres will be fit best to content that is going to teach. The new “representation infrastructures
- 

## Conclusion

New representative distributed learning tools have both advantages and disadvantages. The incoming information is constantly growing. However, being able to access data and information do not automatically increase students' knowledge (Dede, 1996). Accessing to the Internet Genres does not improve student learning as well. Teachers must investigate both advantages and disadvantages of the Internet genres” brings numerous opportunities for both teachers and learners. However, learners also need enthusiastic, well-educated, and caring teachers, better facilities and equipment. Without removing barriers (such as the learner's comfort level with technology, technical shortage, level of interaction, the level of learner's psychological readiness, cultural/individual characteristics, and environmental factors) in front of the learner, we cannot achieve our goal, which is transformation of required knowledge.

## References:

- Bernars-Lee, T. (1996). The World wide web: Past, present and future. [Online]. Available: October 11, 2001 <http://www.w3.org/People/Bernars-Lee/1996/ppf.html>
- Dede C., (1996) Distance Learning to Distributed Learning: Making the Transition. Learning & Leading with Technology, V.23no.7, pp.25-30.
- Harris, J. (2001) Information Collection and Analysis [online]. Available: March 20, 2001 <http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture/Telecollaboration/informationcollection.html>
- Harris, J. (2001) Interpersonal Exchange [online]. Available: March 20, 2001 <http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture/Telecollaboration/interpersonalexchange.html>
- Harris, J. (2001) Problem Solving [online]. Available: March 20, 2001 <http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture/Telecollaboration/problemsolving.html>
- Jonassen, D. (1997). Learning attributes. [Online]. Available: March 13, 2001 [http://pd.12l.org/lrn\\_newlearning.html](http://pd.12l.org/lrn_newlearning.html)
- Lee, J. (1999). Effectiveness of computer-based instructional simulation: a meta analysis. Journal of Instructional Media, 1999, Vol.26. Issue 1 page71-86.
- March, T. (1998). Webquests for learning. [Online]. Available: October 2, 2001 <http://www.ozline.com/webquests/intro.html>
- March, T. (2001). Working the web for education. [Online]. Available: October 1, 2001 <http://www.ozline.com/learning/theory.html>

## Safety Strategies While Surfing Online in the Classroom

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### Abstract\*

*Apparently, the Internet has become an indispensable medium of the 21<sup>st</sup> century. Millions of people are using the Internet for exchanging information, surfing on virtually any topic, communicating with the world, participating in discussion groups, shopping, traveling, and doing many other online activities. The World Wide Web is constantly growing. The Internet offers comprehensive information, instant transactions, communications, and entertainment. The Internet can be used to access reference information such as news, weather, sports, stock quotes, movie reviews, encyclopedias, airline fares, and conducted transactions such as trading stocks, making travel reservations, and banking and shopping online. As an educational tool users have the opportunity to learn virtually anything. Although the World Wide Web can be a world of fascinating and colorful information for students, there are many dangers that children should to avoid, such as sexual, hateful, or violent materials. This paper is a literature review on the Internet safety strategies. The purpose of this paper is to provide parents and teachers some common Internet safety strategies so that they can protect children from the harms of the Internet, based on the literature.*

*(\*) An initial draft of this paper was submitted as a part of the requirements of the course, EME 5207: Designing Technology Rich Curricula, offered by Asst. Prof. Colleen Swain in the College of Education at The University of Florida in Spring 2001.*

### What is the Internet?

The Internet is a network that connects some hundred millions of users from all over the World. It is a place where not only adults but also children have access to and can interact with a wide range of people. Although the Internet has been in existence for 15 years, the number of the Internet users has reached 127 million and has constantly been growing as seen in figure 1 (Shelly, Cahsman, Gunter, 1999). The Internet is commonly being used for exchanging information, making search in various topics, communicating with the world, and participating in discussion groups, shopping, entertaining, traveling and doing many other online activities. Experience of children with the Internet can be fascinating, colorful, fruitful, and enjoyable. However, there are also sites on the Internet that are inappropriate and uncomfortable for a young audience. Thus, great care should be taken while providing children access with the Internet. School is the most popular access point, with more than 80% of youths between ages 10 and 17 saying they surf the Net at school, according to a joint study by the Kaiser Family Foundation and National Public Radio (figure 2). Almost 63% of U.S. public-school classrooms had Internet access by the end of the year 1999, up from just 14 % in 1996, according to the National Center for Education Statistics. Once they are online, children are may be hooked for hours. Among those who use the Internet, 70% of the students say that they use the Web at least once a week at home or school and 35% report using the Net almost every day. On the average, they spent almost 7 hours per month on the Internet - three hours less than adults (Lake, D.2001).

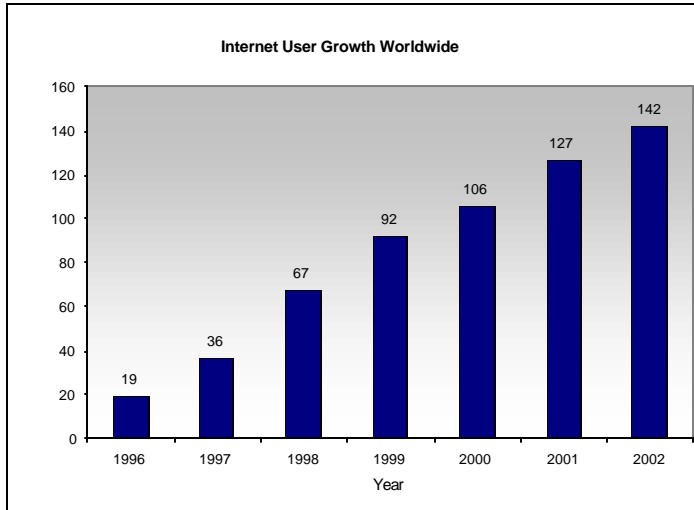


Figure 1. Internet User Growth Worldwide

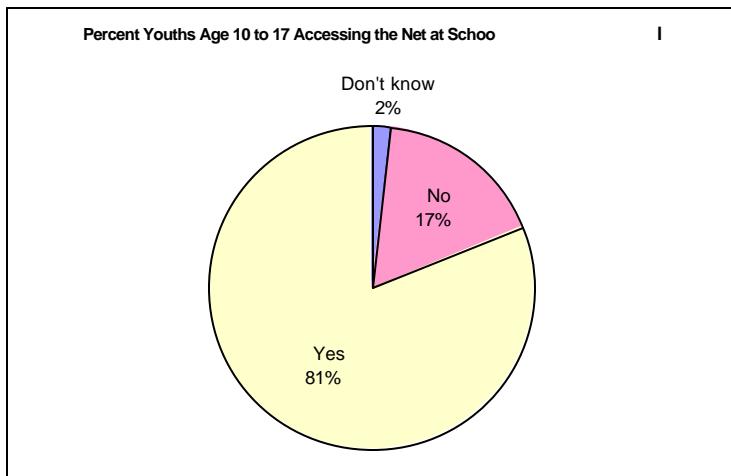


Figure 2. Percentage of Youths Between Ages 10-17 That Access the Internet at School

### Using the Internet: Why It is Worth the Risk

There are numerous benefits of using the Internet in the classroom, which would otherwise have been impossible a decade ago. First, the Internet can expand students' access to resources dramatically by making resources from all over the world for them. Second, students can communicate with other students around the world via e-mail, chat, and instant messaging. Communicating each other, sharing information, exchanging ideas and cultures may improve collaborative learning (Newby, Stepic, Lehman, Russell, 1999). Third, students can access graphics, text, data, articles, papers, electronic books, and video and audio clips that enhance their reading, analyzing, evaluating, and higher-order thinking skills. Also, as an educational tool, the Internet allows students to navigate virtually museums, libraries, and places. Finally, students can publish their knowledge and work on the Internet, which is easier and cheaper than other traditional ways of sharing knowledge and cultural values.

### How Can the Internet Be Used in Classroom Settings?

There are a big number of ways of using the Internet as a learning and activity tool with which students and teachers may engage for learning and sharing knowledge. People who study in the areas of education and teaching; the Internet is an ideal resource, because text and graphic based communication systems are expanded and evolved into powerful multimedia communications today (Shelly, Cahsman, Gunter, 1999). The Internet and the World

Wide Web are by providing a variety of learning tools changing the way teachers instruct and the way students learn basic skills and subjects.

There are several ways to use the Internet in the classroom. First, the Internet can be used as a research tool for projects. Students can easily access a wide range of literature on any topic. Second, it can be used for reinforcing topics already covered in class, for example, for expanding the multicultural aspect of the classroom and as a supplementary tool for curriculum or online reading in classroom. Third, the teacher may keep in contact with students and other teachers around the world. The Internet can also be used for practical applications of theories.

### What Risks are Involved with Using the Internet in the Classroom?

The Internet is a mirror of the society it is being used by. Currently, web publishing is not controlled by any particular organization and there are no regulations in place to verify the information posted. Although the Internet is a comprehensive information resource and a useful teaching and learning tool for education, there are some areas of the Internet that are not appropriate for a young audience. There are sites that depict nonconsensual act of violence, explicit sexual sites or promote racism, anti-Semitism, and hatred (Magid, 2000). Another risk is that, while online a student may provide information or arrange an encounter that could risk his/her safety or safety of other persons (Magid, 1998). Students have been known occasionally to provide personal identifying information to strangers -either knowingly or not-such as password, home, or school address, phone number that could endanger their mental and physical condition. Also some information, graphics, and video and audio clips acquired from the Internet may not always be accurate and appropriate. Additionally, the Internet can be used as a device with which to play or spend time off task. It is als o viable to break numerous laws including “computer hacking” and copyright violation. Educators should preview materials and provide supervision for ensuring children’s safe use of the Internet. These strategies and approaches can be different in different circumstances depending on the audience’s age, knowledge, and cultural background. Indeed, violence, pornography, and predators on the Web are more serious threats to children’s exposure than other threats.

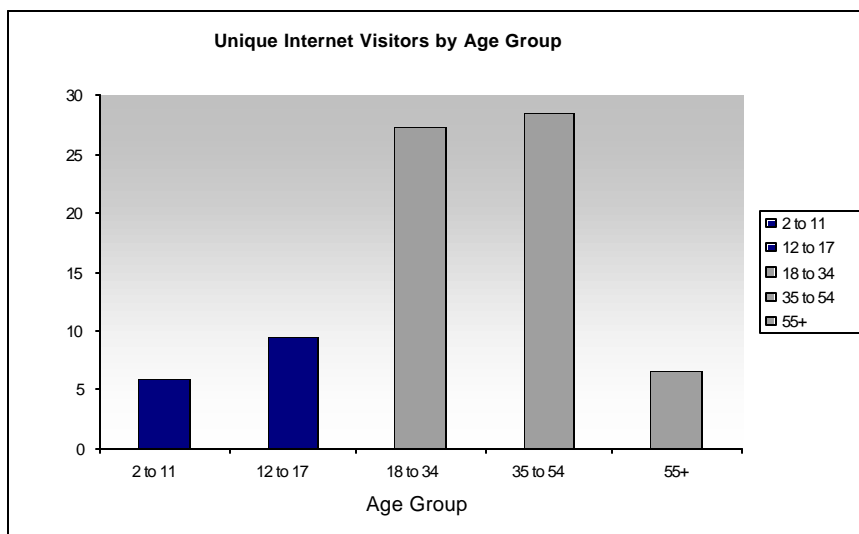


Figure 3. Unique Internet Visitors by Age Group

A recent survey certainly indicates that kids are fueling the Internet explosion. Polling firm Grunwald Associates found in their just-released study that 25 million 2 to 17-year-olds are online in the US right now, up from 8 million in 1997.

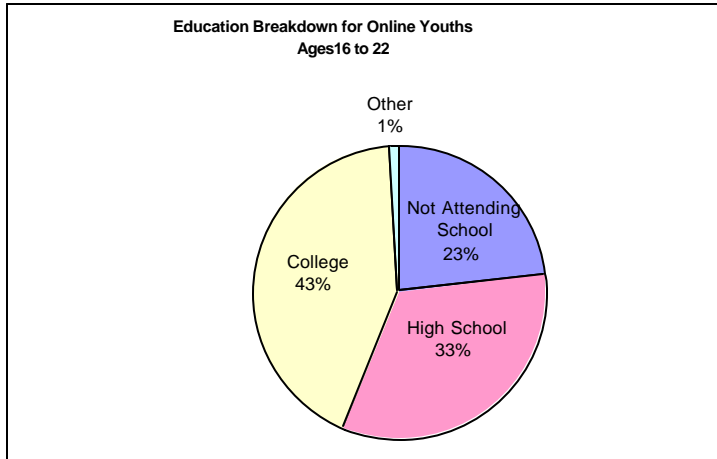


Figure 4. Education Breakdown for Online Youths

About one in five 10 to 17-year-olds surveyed said they have received sexual solicitation or approach via the Internet in the past year, according to a study released this week by the National Center for Missing and Exploited Children (NCMEC). Another key finding was that one in four of the children surveyed said they've had unwanted exposure to pictures of naked people or people having sex in the past year. The study "Online Victimization" available online at [www.netfamilynews.org](http://www.netfamilynews.org) is an important contribution to the public discourse about the Internet's impact on kids. It calls for "private and public initiatives to raise awareness and provide solutions," including strategies that reduce the amount of offensive behavior toward kids, help shield parents and teachers from it, and give them the tools they need to cope with both the behavior and its consequences. According to the study large numbers of youths encounter offensive experiences on the Internet. Twenty percent were sexually solicited, 6% were harassed. The offenses and offenders are diverse, not just men trolling for sex. Much of the offensive behavior comes from other youth, and some from women as well. Teenagers are the primary targets, creating a different sort of challenge than would be the case if younger children, over whom parents have more control, were the primary targets. Although most solicitations fail, the sheer numbers are alarming. Several million young people, ages 10 to 17, are sexually propositioned on the Internet every year (Dede, 2001).

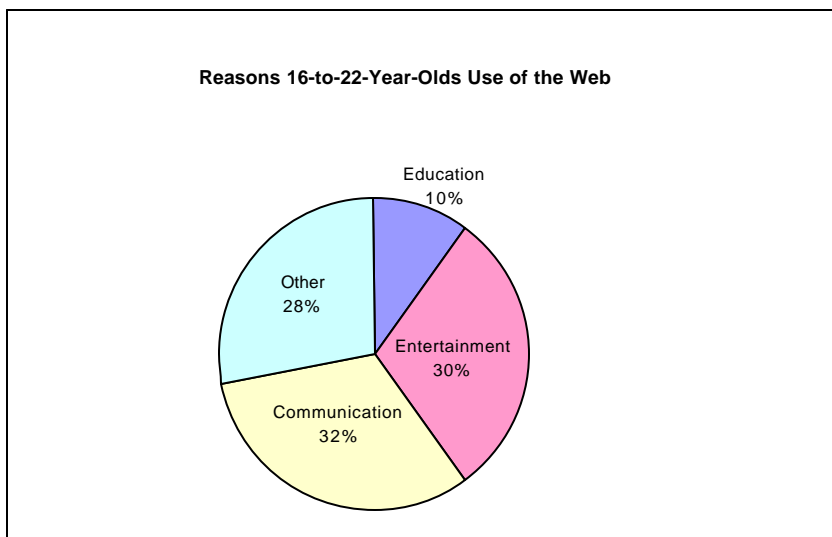


Figure 5. 16-22 Year-olds' Reasons to use the World Wide Web

**Safety Issues in The Classroom: What teachers should do**

This paper focuses mainly on the safety strategies for 6-12 grade level at schools, because they are thought to be the most affected persons by harms of the Internet. At these grades students are just beginning their move



toward independence and can no longer be told not to do something without being given a well-argued reason for the rule. At these ages, students need guidelines and assistance with their decision-making. They also need clear guidance for appropriate uses of the Internet, while given information to understand the reasons behind the enforced directions. Careful preparation is the key to effective and safe use of the Internet in the classroom.

### **Preparing Students**

In order for them to be completely prepared for navigating the Internet safely in the classroom, students need to learn what defines ethical behavior on the Internet. Essentially ethical behavior on the Internet is the same as ethical behavior in every other aspect of life. Students need to know that they should never menace or harass people they meet online or offline. They also need to know that they should not use language that is offensive to others. A good general rule that the students can follow is “Don’t say anything to people you meet online that you would not say to your parents, teachers, friend, or religious leader”.

### **Teacher preparation**

Students need the teacher’s support and involvement in learning how to make positive choices. Teaching involves helping students to cope with problems encountered online and providing them with the set of skills, they will need to make the right choices in the absence of their teacher or parent.

There are several ways teachers can prepare themselves and students while surfing online. First, before starting to use the Internet, teachers may give a short lecture about how to use the Internet browser software. Second, to teach ethical behavior on the Internet the teacher may open a discussion about the issue. Opening a discussion, they enable students to think critically about issues as the teacher guides them toward a better understanding. Teachers can also have the students role-play different situations on the Internet or can use examples to help students to come to a better understanding of the issues. Students should be informed of the Internet use policy including the rules of computer use and Internet access. The teacher must make sure that the students have read and signed the Internet Use Policy. Making clear what the penalties are for misusing of the Internet may reinforce students to use the Internet in a proper way. Teachers must also forward the policy to the parents. It is very important to keep parents informed about the activities that the students are involved in the classroom. Sending a newsletter and the Internet and computer use policy, and requiring students to return signed parental forms prior to each semester are some suggestions for teachers. They can also provide a computer workshop for parents prior to each semester in order to allow parents to review both the hardware and software their children will be using. Teachers make their phone number and e-mail address available to all parents to give the parents the ability to contact the teacher with any questions they may have.

Another preparation strategy for teachers is to provide a list of web site addresses that will be used in the class prior to classroom use. Students must be monitored while they are surfing on the Internet. Also filtering or blocking software can be used in the classroom computers to protect students. However, filtering software is practically not often capable of filtering out sites that contain unwanted materials for students. Also sometimes a valid content may be screened out inappropriately. Thus they are not to be relied on completely instead they should be supplemented with other strategies. It is a good idea to make sure computer screens can easily be seen by the teacher in the classroom (Magid, 2000). During an Internet lesson, teachers may roam the classroom observing what students are viewing. Most browsers keep in their history a number of short-term records of the recently visited sites. There are also monitoring systems that provide a record of the web sites a person has visited on the Internet. The monitoring systems and browsers’ short-term records are low cost solutions for teachers to monitor their student in the classroom (Dede, 2001). Lacking the awareness of dangers the Internet can pose students unintentionally wonder places where their innocence and safety are compromised.

### **Safety Rules and Guidelines for Student Classroom Internet Use: What Students Need to Know**

The use of school computers and computer networks, computer software, data files, Internet access, and intellectual property in the classroom is a privilege and is intended for educational purposes only.

The following list contains guidelines by according to which students should use the Internet during both their usual class hours and any time they may spend on the school’s computers. This list is not meant to be a final list of what is or is not acceptable while using the Internet in class; however it provides some insightful ideas. If students are not sure about how to behave in a certain case they should ask their teacher. The set of rules students should obey in class include but are not limited to:

- Share computer account usernames or and passwords except when authorized.
- Create, copy, receive, or use data, language, or graphics which are obscene, abusive, or otherwise inappropriate at school
- Access, change, or delete computer programs, data files or electronic mail belonging to others without permission.
- Steal or destroy school computer hardware or peripherals.
- Steal or destroy computer software or data files owned by the school or others.
- Violate or attempt to violate the security of computer network systems.
- Take unauthorized actions, which deny access to, disrupt, or destroy the service of the computer network system.
- Make unauthorized or unlawful installation of personal computer software on the school computers or networks. Including, but not limited to games, virus programs, and applications software. Student provided software must be used only in accordance with the license.
- Use computers, networks, or peripherals to create a forged instrument.
- Use computers, networks, software, data files, or intellectual property in any unauthorized way.

(This list of classroom rules was adopted from “School Board of Alachua: County District Technology Plan” Available on-line at <http://www.sbac.edu/district/techplan.html#anchor16496056>, p.12.)

### **Computer Use Policy in the Classroom**

- Computers should only be used for school related, educational activities.
- Chat rooms and Newsgroups may not be accessed.
- Purchases over the Internet are not permitted.
- Student cannot give out information about himself/herself such as personal phone numbers, address, passwords, last and first name, and other identifying information.
- Students cannot send a picture over the Internet or through regular e-mail to anyone without the teacher's permission.
- Student cannot respond to any messages that are mean or in any way make him/her feel uncomfortable.
- Student must tell his/her teacher; if something seems confusing, scary, or threatening online.
- Student cannot have a face-to face meeting with someone he/she has met online.
- Students and teachers will be required to log-in and log-out on the Internet.

(Adopted from “Hidden Oak Elementary School Gainesville, FL” computer use policy form.)

### **Conclusion**

Most educators try to integrate technology and the Internet into classes to enhance students’ learning and achievement. Although the Internet is an invaluable resource and a comprehensive research tool, it includes potential dangers and unsafe places as well. The speedy growing use of the Internet in the classroom by students has caused teachers to be increasingly concerned about students’ safety using the Internet. The best way to assure that students are having fruitful online experiences is to monitor what they are doing. Teachers should spend time with students while they are online. The next step is to establish some basic rules for students’ use of the Internet. While students need a certain amount of privacy, they also need guidance and supervision in their lives. By taking responsibility for students’ use of the Internet, teachers can greatly minimize any potential risks of being online.

### **References**

- Dede, C. (2001). Young people and the "Dark Streets". [Online]. Available: October 11, 2001, <http://interact.hpcnet.org/webcommission/privacy.htm>
- Lake, D., (2001). Youth: next on the net. [Online]. Available: October 14, 2001, [http://www.thestandard.com/article/0,1902,15636,00.html?printer\\_friendly=](http://www.thestandard.com/article/0,1902,15636,00.html?printer_friendly=)
- Magid, L.J. (1999). Lessons children learn on internet safety can be lesson for living. [Online]. Available: <http://www.safekids.com/articles/lessons.htm>

Magid, L.J. (2000). Concern for children's safety should shine light on dark alleys of cyberspace. [Online]. Available: March 21, 2001, <http://www.safekids.com/articles/childsafety2000.htm>

Newby, J.T., Stepic, D.A., Lehman, J.D., Russell, J.D. (1999). Instructional technology for teaching and learning: Designing instruction, integrating computers, and using media (2<sup>nd</sup> ed.) Ohio: Merrill.

School Board of Alachua: county district technology plan (2001) [Online]. Available: <http://www.sbac.edu/district/techplan.html#anchor16496056>, Page 12.

Shelly, G. B., Cahsman, T. J., Gunter, R. E. ( 1999). Teachers discovering computers: A link to the future: web and CNN enhanced (1<sup>st</sup> ed.).M.A., Course Technology, Inc.

Sources for graphics: (Lake, 2001) & (Shelly, Cahsman, Gunter, 1999).

# Looking for the hype in hypertext: An essay deconstructing pedagogical assumptions associated with online learning and instructional design.

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## Abstract

*This paper aims to debunk the metaphysics of presence informing modernist pedagogical assumptions. Systematic instructional design, predicated on teleological and eschatological modern metaphysics, superordinates designer's goals at the expense of learners. Tracing structuralist pedagogical theory to Bobbitt (1997) and Tyler (1949), one can readily see the roots of popular instructional design models, such as Smith and Ragan (1993), Mager (1997), and Dick and Carey (1996). If, however, we look to pragmatism and post structuralism, we can find alternatives to reductive and straight-line pedagogical theories and thereby construct emergent and transactional learning spaces in which learner input is valued. Pragmatist and postmodernist pedagogies, moreover, place an emphasis on mediation.*

## Introduction

The hype is that online, virtual sites will free students, instructors, and administrators from many of the limitations proximal lectures have presented over the years from universal, homogenized pedagogies to reduced infrastructure costs. This paper will examine certain entrenched modernist learning assumptions and counterpoise these with post-modernist and pragmatist sensibilities that seek to take advantage of the current digital revolution in order to improve the educational possibilities for online learning. The emphasis here is pointedly on learning not education as a social institution. As Dewey (1944) noted in the earlier half of the last century, institutionalized education can stifle the natural urge to learn when a society's goals become superordinate to the individual learner's, thereby dampening a learner's desire to grow in an educational context. Typically, instructional design models predicated on fixed objectives seriously limit the likelihood for an emergent learning transaction to occur. The purpose of this paper is to deconstruct many of the underlying pedagogical assumptions informing typical and popular instructional design models, particularly systematic ones, and to offer some alternatives. Using such alternatives will hopefully open hypertextuality to more dynamic potentials for realistic learning.

## Modernist pedagogies

The torturous route to Modernist assumptions of knowledge have roots dating back to the Platonic dialogues and Aristotle's philosophical works, through the Neo-Platonists (Augustine) and Medieval Scholastics (Thomas of Aquinas), adopted by such seventeenth century philosophers as Descartes and Newton, and passing through Philosophers such as Diderot and Rousseau. In the modern era, the two most commanding figures influencing curriculum theory and underlying assumptions of knowledge transfer are Bobbitt (1997) and Tyler (1949) (Applebee, 1996; Gress & Purpel, 1979; Flinders & Thorton, 1997; Walker & Soltis, 1986).

## Bobbitt's Curriculum

Franklin Bobbitt's The Curriculum (1997) initiated modern curriculum theory (Walker & Soltis, 1986). Bobbitt should be considered what Eliot Eisner (1994) refers to as a rational humanist. A rational humanist believes that foremost, humans are rational animals capable of discerning truth from dedicated and exhaustive empirical study. While this seems a just attitude for determining intelligence at first glance, a more dedicated and exhaustive examination reveals that the rationalist believes that the universe is ultimately knowable if one only discovers certain physical truths. The pseudo-scientific emphasis then resorts to what Dewey (1944) calls the metaphysical fallacy that knowledge preexists inquiry and is fixed with a final end. Even Rousseau's Emile (1962) underscores this faith in ultimate and final knowledge that the enlightened mind can achieve when living in accord with one's natural attributes uncorrupted by society. Dewey critiques this fallacious assumption:

But the notion of a spontaneous normal development of these activities is pure mythology. The natural, or native, powers furnish the initiating and limiting forces in all education; they do not furnish its ends or aims (p. 114).

The problem with both Rousseau's natural development pedagogy and Bobbitt's social efficiency pedagogy is that they are based on teleological paradigms: for Rousseau, the best education takes advantage of a

person's innate abilities as if abilities are a priori and not learned behaviors; for Bobbitt, a society should train future citizens to do the job of today for 30 or more years in the future as if economic and social needs will remain static. Dewey points out just how myopic Bobbitt's social efficiency, structuralist planning model is:

Industry at the present time undergoes rapid and abrupt changes through the evolution of new inventions. New industries spring up, and old ones are revolutionized. Consequently, an attempt to train for too specific a mode of efficiency defeats its own purpose. When the occupation changes its methods, such individuals are left behind with even less ability to readjust themselves than if they had a less definite training (p. 118).

A social efficiency progressive believes that society can determine what is best for itself and use this knowledge to call upon certain educational reforms aimed at improving the nation. Such assumptions underscored the drive for Physics and Mathematics after the Soviets launched Sputnik and the current emphasis on business training in education so that American educational products can compete in a global market. This underscores education external to a learner, that society determines what is best for the pupil. In contrast, social justice progressives, championed by Dewey, sought expanded democratic participation, social reform, and more equitable wealth distribution. Bobbitt favored preparing students for society, as expert planners perceived it actually existed or would exist. The difference lies in that social justice progressives favored a fluid planning society while social efficiency progressives favored a fixed, planned society.

As Bobbitt (1997) sees it, "the era of contentment with large, undefined purposes is rapidly passing. An age of science is demanding exactness and particularity" (p. 10). Then as now, this stance suggests rigid, external objectives, and standards of learning determined by science. What science meant for educators and politicians then as now is some version of positivism with it presumed "hard facts" along with theory and value neutral inquiry, or what Bobbitt calls investigations "without pre-suppositions" (p. 13). Bobbitt optimistically announced, "Experimental laboratories and schools are discovering accurate methods of measuring and evaluating different types of educational processes" (p. 10). It does not matter that the positivist image of science is theoretically dead; ghoulishly, it lives on to dominate educational practice.

Bobbitt (1997) supposes that aiming for externally expert determined goals, students have the highest likelihood for succeeding and so did the nation. Bobbitt wrote that to "train thought and judgment in connection with actual life-situations" (p. 9), will accomplish his goals. Accordingly, we can deconstruct Bobbitt's basic ideas from the following passage:

Human life, however varied, consists in the performance of specific activities. Education that prepares for life is one that prepares definitely and adequately for these specific activities. However numerous and diverse they may be for any social class, they can be discovered. This requires only that one go out into the world of affairs and discover the particulars of which these affairs consist. These will show the abilities, attitudes, habits, appreciations, and forms of knowledge that men need. These will be the objectives of the curriculum (p. 11).

It is easy to identify the false social Darwinism embedded in the idea that we should educate social classes for their probable destiny. The "rationality" of social efficiency demands social reproduction. Tracking and the differentiated curricula associated with it serves as a social sorting machine for a society that avoids critical democratic deliberation. As Aldous Huxley (1965) wrote in Brave New World Revisited the social ethic that holds humans as entirely social organisms programmable to social needs as part of a collective hive undermines our humanity, our biological and social uniqueness. Such curriculum planning as Bobbitt advocated presumes such passivity and interchangeability to the socio-economic machine.

Gress and Purpel (1979) remark that Bobbitt's "model of curriculum planning . . . [has] survived a half century's thought and practice in one form or another" (p. 237). Walker and Soltis (1986) write, "The performance-based and competency-based teacher education movement of the 1970's repeated this mode of curriculum construction" (p. 55). The same holds for the "standards" movement over the last decade. The enduring appeal of Bobbitt's objectives and standards approach lies in its putative appeal to modern notions of "reason," objectivity, and measurement. The promise of permanent progress is also modern, though the reductive methodological assurances of a safe and secure, if narrow, path to a perfect and predetermined teleological essence, is pre-modern as is the metaphysics that supports it.

### **Tyler's "Rationale"**

The most influential name in curriculum theory is Ralph Tyler (1949) (Applebee, 1996; Flinders & Thorton, 1997; Walker & Soltis, 1986). Gress and Purpel (1979) note that the "basic elements of" Bobbitt's "work underlie Tyler's classic formulation" (p. 237). The classic work is Tyler's Basic Principles of Curriculum and Instruction (1949). The following excerpt comes from Tyler's "rationale:"

[F]our major tasks serve as the focuses of curriculum construction: The selection and definition of the learning objectives; the selection and creation of appropriate learning experiences; the organization of the learning experiences to achieve a maximum cumulative effect; and the evaluation of the curriculum to furnish a continuing basis for the necessary revisions and desirable improvements (p. 246).

Tyler focuses on predetermined objectives lying outside the student's activity. Presumably, these objectives are so valuable they must serve as the essential tools of all learning. Tyler assumes that concrete and predetermined objectives will make education more efficient and effective regardless of academic discipline; accordingly, Walker and Soltis (1986) state, "Tyler . . . proposes that a school's philosophy be used as a set of standards to 'screen' the objectives derived from this first step in the process. This will ensure that each objective is in harmony with the school's general philosophy and ideal aims" (p. 56). The assumption is that the philosophy of the school establishes the valued objectives for which Tyler has a value neutral tool of means-ends rationality for achieving. This tacitly assumes the old positivist fact versus value dualism as well as the means versus ends one. Most schools, of course, will presume that his methods like most others and most media are value neutral relying on traditional metaphysics' supposition that the ends, the content, are most essential in education.

One should also consider Tyler's (1949) stance on learning experiences. The guiding idea is that of "sequence and integration" (p. 251). Tyler declares,

Curriculum makers can also identify significant skills that are sufficiently complex and pervasive to serve as organizing elements to achieve sequence and integration. And, for objectives involving attitudes, appreciations, interests, and personal commitments, curriculum makers can identify important values that can serve as organizing elements (p. 251).

This is the seductive old idea of curriculum vitae as a straight line, secure, and certain method for being safely shepherded through hazardous terrain. While this straight-line approach, with proscribed learning goals as predicated by Mager (1997) and Dick and Carey (1996), makes creating instruction easier, it does little to prepare learners for the unknown realities of tomorrow.

Finally, there comes evaluation to which the code word today is accountability. "I employ the term," writes Tyler, "to include the process of comparing the ideas and assumptions involved in curriculum development with the realities to which they refer" (p. 252). Although he does not say so, evaluation presupposes a philosophical bent since evaluation obviously requires that we reflect on the values we espouse in making our selections of objectives, means for obtaining them, and the organization of those means. What is odd is that Tyler, again implicitly, seems to think he has a value neutral method of evaluation. Things are much the same today.

Commenting on Tyler's rationale, Walker and Soltis (1986) conclude,

He makes no commitment to certain ideal aims, specific objectives, a particular program, or one conceptualization of curriculum phenomena over another . . . . His commitment is to a highly rationalized, comprehensive method for arriving at logical and justifiable curricula of many different kinds (p. 58).

Curriculum is method's child, and content's orphan; the methodological form versus subject matter content dualism is untenable. Walker and Soltis also conclude that the Tyler "rationale" is "the paradigm, the dominant model of twentieth-century thought about curriculum design (p. 55). Nothing has changed in the twenty-first century largely because the Tyler rationale has all the ingredients characteristic of modern thinking, including a firm commitment to "rationality," progress, theory (or philosophy) independence of fact, value neutrality, a profound commitment to an external tools as the essence of action, and faith in "method" for arriving at the highest value, the summum bonum, the supposedly value neutral content.

## **Pragmatist and Postmodernist Pedagogical Sensibilities**

### **Dewey's Democratic Pedagogy**

In opposition to these rational humanist and social progressive philosophical blinders, John Dewey remarks in Democracy and Education (1944), education is growth. Living beings must continue to learn in order to sustain life: "life is a self-renewing process" (p. 9). Education occurs naturally through transaction with others and within environments. Human society seeks to control, guide, and discipline this process in order to sustain its viability: "In directing the activities of the young, society determines its own future in determining that of the young" (p. 41). Hence, society's desire to renew itself, to varying degrees, can be seen as a progression from an individual's desire to sustain him or herself. Dewey problematized his earlier distinction between education and schooling in his reconsideration of Democracy and Education (1944), Experience and Education (1997). Growth as education occurs naturally as a state of disequilibrium in which an individual attempts to reestablish equilibrium through inquiry.

Schools, as institutionalized loci for disciplined learning, seek to guide this process so that society can continually be self-sustaining. The problem lurking within this neat summation resides in disharmony. When either extreme, subject-oriented education versus object-oriented education, takes precedence over the other, growth is hindered. The pendulum has swung back and forth between the individual's desires and the society's desire since people have debated curriculum. Currently, this is particularly true in instructional design with its overweening emphasis on goals. Dewey maintained that goals are important, but these are goals in view – ideals of what we want to achieve that occur rarely in exactly the way we had initially envisioned. Goals are, therefore, contingent and emergent by nature because reality intervenes changing our goals to fit circumstances and ever-changing contexts.

### **Foucault's Discipline and Punish**

In modernist pedagogies and systematic instructional design models, we see an example of Foucault's concept of "docile bodies," which manifests itself as the science of behavioral control in a clinical environment. "Docile bodies" relates how "modern disciplinary technology does for the human body and the body politic what Newton had done for physical bodies;" in other words, it has created Man-the-Machine; as Garrison & Burton (1995) claim instructional designers all too often presume students are thinking machines and extensions of their tools (pp. 72-3). Moral accountability can now be quantified as a numerical representation, grades; political control thereby manifests itself as the inexorable controlling agent in this utilitarian rationalization (p. 73). As for correct training, Foucault (1979) delineates a tripartite hierarchy of power: hierarchical observation – the teacher constantly monitors student activity exemplified by traditional classroom organization; normalizing judgment – the culture restructuring itself by enforcing student accordance with a hegemonic episteme; and examination – determining if students meet the standardized criteria that de facto reify socio-political norms. Unfortunately, Foucault's (1979) warning that such a system predicated on an all seeing and centralized eye, a panopticon, can come to fruition in this climate. The reliance on a hierarchy sorts individuals as objects into ability categories depending on how well they score on exams developed from norms taken, in turn, as fixed or natural categorization models. Such models assume that the norms are value neutral, but even a cursory glance at the material constituting standardized tests; one can see that the material is biased towards the hegemonic values of a society's social elites. As Becker (1998) points out, such tests are highly value laden based on the skills that dominant social groups value, and mistakenly taken as raw scores of intellectual ability and gauges for future success – as long the same dominant group defines success.

In a rational world, scientists (social and physical) discover the essential meaning of things, the monad. Latour (1987) remarks how in typical scientific processes, real things are abstracted into laboratory symbols cleansed of interference from the outside world; such abstractions have little to do, however, with the initial thing that actually exists in its environment. In a less rational world, one that is not reduced to the world as a controlled laboratory, essential meaning is a chimera, so why should we base our pedagogies on a worldview that purposefully ignores the richness, diversity, and complexities of what it is to be human caught up in the nebulous sweep of existence? Foucault in The Order of Things: An Archeology of the Human Sciences (1971) provides an answer: because people in power, who claim to discover truth, actually construct it. Foucault writes, "the problem is not changing people's consciousness – or what's in their heads – but the political, economic, institutional regime of production of truth" (p. 133). When we acknowledge that truth is not fixed in an ultimate origin (arche), is not predestined to a specific end (tools), nor has an essential value (monad), we can see that reality (ousia) is contingent on context and one's perspective within a given locus. When this emancipatory vision occurs, we can pull down the edifices that sustain hierarchies, rules, and categories as givens and rebuild pedagogy around concepts of relevance.

### **Freire's Pedagogy of the Oppressed**

Instructional design methods typically rely on specious pedagogical strategies of "facilitat[ing] knowledge transfer," which Freire (1973) critiques as the banking concept of learning. In Pedagogy of the Oppressed, Freire stipulates that humans exist to change the world through dialogue: "To exist, humanely, is to name the world, to change it" (p. 150). Naming the world occurs in transacting with the world. Transaction is a process within a functioning democracy; domination of dialogue, becoming a monologue of the dominator transferred onto the dominated, manifests itself as pedagogical sadism. Tragically, this sadism is the typical instructional design mentality in which the content and content specialist, master the student and correct the student behavior though grades dictated upon how well students retrieve information placed in their long-term storage. Freire claims in the banking concept of education that the teacher deposits knowledge, much like a capitalist would, in order to retrieve his or her funds at a later date, in this case from the student/bank, with interest. The accrued interest, on top of the

correct response to the answer, is the student's mindset that he or she is essentially powerless in this exchange. The dividend for the capitalist is proletariat passivity.

### **Eisner's Three Curricula**

Using Eisner's (1994) three curricula – explicit, implicit, and null, – we can deconstruct what Tech intends to promote: explicit, the agenda illustrates desire for responsible, self-sufficient, active learners, who proactively contribute much to their own learning goals and methods; implicit, the methods are designed to make students react to external stimuli in a proscribed manner (e.g. fill-in-the-blanks and multiple-choice), creating passive students given precious little room for critique and analysis, two keys for active learning; null, the content is predetermined and predominate, so little freeplay exists for student discovery—the assumption here is that knowledge is finite, fixed, and ultimately determinable to an absolute value. Tech has pronounced a knowledge-in-action agenda, yet has promulgated a knowledge-out-of-context methodology. The strength of this instructional design is that students tend to do better on conduit model testing, yet their critical analytical skills suffer: “Such a curriculum of knowledge-out-of context may enable students to do well on multiple-choice items. It does not enable them to enter on their own into our vital academic traditions of knowing and doing. They lack the skills to develop interpretation, to analyze a new situation, or to muster evidence in support of new arguments and unexpected opinions” (Applebee, 1996, p.33). The underlying problem resides in the privileged status of the content as the origin, ends, and fixed meaning of knowledge. We are carrying the baggage from Plato's “myth of the cave” where knowledge, episteme, is ultimately and permanently definable to a fixed point—a monad. This, in turn, leads to suspect pedagogical methodologies that emphasize knowledge-out-of-context. Applebee (1996) describes how this mindset affects methods:

Educators have relied on classroom practices that focus almost exclusively on memory, allowing goals of active reasoning and participation to fall by the wayside. Instead of the knowledge-in-action that both allows and develops through participation in culturally significant traditions of discourse, we have emphasized the knowledge-out-of-context that comes from studying its characteristics (p. 26).

This reliance on a contextualized knowledge may well enable students to do well on multiple-choice and fill-in-the-blank tests, but does precious little to prepare them for a world that does not function in such a reductive manner. Subsequently, this method instills a dichotomous world-view in which students learn that real world decisions can be distilled to either/or solutions that reduce complexity at the expense of creativity.

The task at hand is to find ways to salvage the goals of the academic agenda from the myopic and ill-conceived methods adopted from information technology. In this decade scholars from various disciplines have offered warnings about assumptions inculcated within this transformation (I use this term generously for now because pedagogical praxis has undergone precious little change while the medium has) and propositions for offering students to become more participatory and active learners in the environment. If we give heed to and adopt humanist, post-structuralist, and pragmatic misgivings and sensibilities respectively, we may actually take some meaningful steps towards skilling active participants in a multivocal and participatory democracy – a much more preferable locus in a public university than jumping so readily into bed with market place positivistic assumptions. Specifically, I intend to look at Garrison and Burton's (1995) warnings voiced in “Power, Knowledge, and Hypermedia” and George Landow's (1994) call to move hypertext towards post-modernism delineated in Hypertext: The Convergence of Contemporary Critical Theory and Technology.

### **Garrison and Burton's Skepticism**

Garrison and Burton (1995), in “Knowledge, Power, and Hypermedia” cite Nelson's critiques of scientific learning theories harking back to Taylor and Bobbitt's scientific management models that have resurfaced in current conduct and accountability centered educational models demanding that education emulate the market place. Nelson balks at the oppressive nature of bureaucratic scienticism that often fails to take learner relevance and educational context into consideration. In contrast, Nelson offers his Xanadu concept focusing on open hypertext as opposed to universal hypertext. Open hypertext, simply put, allows users to create their own links and add information to a naturally evolving matrix, whereas a universal hypertext, much like Vannevar Bush outlined in “As we may think,” is constructed by specialists bound by fixed hierarchies and standardized rules. In the former case, we have “computer-text-system people” who value everyone's contribution; in the latter case, we have “information Lords” controlling content and access by “information Peons” (p. 71).

### **Landow and Hypertextuality**



Landow holds forth hope that hypertext, hypermedia, and on-line learning environments may accomplish some of the post structuralism goals: “we must abandon conceptual systems founded upon ideas of center, margin, hierarchy, and linearity and replace them with ones of multilinearity, nodes, links, and networks” (p. 752). Landow emphasizes that electronic links create more easily accessible “lexias” to external links increasing the viability for intertextuality. This intertextuality, in turn, helps reduce the status of the author at the expense of the reader: “hypertext blurs the boundaries between reader and writer” (p. 755). Barthes’ “readerly text” comes to the fore seeking to create a text for active readership and disestablish the “pitiless divorce” between producer/user, owner/customer, and author/reader to which one may readily add teacher/pupil (p. 755). The non-linear links in a hypertext and the reader’s ability to add to the text, involving feedback from other writers, offers a more active role for the traditionally passive reader. The reader/student becomes an active participant in making meaning thereby increasing the relevance and the links to the reality of the transactional, lived experience.

### **Derrida’s Deconstructing of the Transcendent Signified**

With respect to Derrida (2000), hypertext offers a text more closely aligned to our lived experiences in which context as the center of meaning takes the place of a contextualized truths or structural centers. A living hypertext is constantly restructured and recentered as the context shifts creating an infinity of new contexts. Hyperpedagogy uses a similar paradigm in which the class – here defined as participants, content, and context in a transactional environment – becomes an assemblage or a constantly mediated montage of meanings. Derrida quotes, “I believe that the center is a function, not a being—a reality, but a function. And this function is absolutely indispensable” (p. 495). By moving the locus of significance from essence to function, Derrida effectively deconstructs the viability of fixed meaning that examination standardization strategies, conduit-teaching models, and panoptic pedagogies that rely heavily on prerequisites and like-minded philosophical assumptions.

Derrida (2000), in “Structure, Sign, and Play in the Discourse of Human Sciences,” questions the function of structuralism by deconstructing certain Platonic and Cartesian assumptions regarding the privileged status of structural centers. After Derrida concludes his argument, the validity of the “myth of the cave” from Plato’s *Republic* (1985) and the *cogito ergo sum* from Descartes’ *Meditating on First Philosophy* (1993) lay in shards. He stipulates that Western philosophy’s foundational assumptions, so deeply intertwined within the structure of episteme, need to be seriously reevaluated. The center of traditional philosophical structures, at once part of the structure and simultaneously existing transcendentally beyond its grasp, are not centers at all. Transcendence is a central tenet in the metaphysics of presence, what Derrida labels the transcendent signified. When we remove the concept of transcendent signified and allow for freeplay, we extend the domain and interplay of signification infinitely (p. 496). As he stipulates, “Freeplay is the disruption of presence” (p. 508). Recognizing that structures are flexible and adaptive to the demands of place and time, ruptures the eschatological belief in epistemology inexorably linked to the ideologies of ultimate knowledge (episteme), origins (*arche*), and ends (*tools*). Reality is no longer a discovered monad or essence confined by the alpha of *arche* and the omega of *tools*. By admitting freeplay room in our concepts of reality, we can deny the dualities inculcated within the metaphysics of presence: *physis/nomos* and *physis/techné*. As Derrida writes, “the whole historical chain which opposes ‘nature’ to the law, to education, to art, to techniques—and also to liberty, to the arbitrary, to history, to society, to the mind” deconstructs the limitations placed on pedagogues to reconstruct reality and teaching models (p. 499). Derrida, furthermore, writes how deconstruction of utilitarian empiricism will expose the limitations of ideologies invested in fixed, timeless, a contextual truths; seen as tools, however, we can reconstruct reality as a function. By breaking down these dualistic barriers – the supposedly inherent tensions between culture and nature, mind and body, education and nature – fade into irrelevancy.

Regarding the prevalence of dualisms/binaries, Bowker and Star (1999) argue that tensions often arise from globalization of categories. Local categories, meaningful segmentation of the overwhelming myriad of reality, upon becoming universal standards, codified and global, lose relevance to immediate tasks at hand and act as barriers to understanding. Moreover, those who codify global standards take on the mantle of authority and usurp the power away from the recipients of their seemingly arbitrary categories, much like the relationship described by Nelson between information lords and peons.

When we accept that knowledge is neither teleological nor eschatological, we can question the privileged status of the text and teacher, the quintessential classroom authorities. In order to question the myths surrounding the author, we need to investigate textual possessions. Simply put, textual possessions refers to the fact that most effective (and the most affective) on-line collaboration and instruction occurs as on-line textual communication not as multimedia lectures that emphasize the privileged status of the content and the content specialist. Therefore, poststructuralist theories concerning text, particularly those promulgated by Derrida, Foucault, and Barthes, are

especially relevant. Moreover, collaborative work in digital culture should more closely resemble renaissance coteries than the authorial work models predominate in print culture. In coteries the primary method for sharing knowledge was not conduit model – the textbook and professor as the source of static knowledge to be recited much like a litany – but a dialogic one in which the contributors engaged in dialectic disputation (Downs-Gamble, 1995). The renaissance manuscript chapbook was mutable, emergent, and co-produced text neither definable to a fixed value nor attributed to a single author. The latter term itself is problematic because its etymology resides in the Latin root auctores, meaning the authority on a subject typically referring to a religious subject (Pask, 1996).

### **Foucault, Barthes, and Authority**

Foucault (1997) and Barthes (1998a) deconstruct the concept of author in respectively, “What is an Author” and “Death of the Author.” For Foucault the modern conception of author “constitutes the privileged moment of individualization” (p. 890). He writes that writing is a jeu (game/freeplay) of a writer as part of a matrix: “it is a question of creating a space into which the writing subject constantly disappears” (p. 890). This claim denies the privileged place of author/professor/content specialist/instructional designer as the authority on a particular, set subject or method of teaching. He pits the historical function of author against the modern ideal of author. He writes that historically the author-function exists as four primary characteristics: (1) the author-function is linked to the juridical and institutional system that encompasses, determines, and articulates the universe of discourses; (2) it does not affect all discourses in the same way at all times and in all types of civilization; (3) it is not defined by the spontaneous attribution of a discourse to its producer, but rather a series of specific and complex operations; and (4), it does not refer purely and simply to a real individual, since it can give rise simultaneously to several selves, to several subjects—positions that can be occupied by different classes of individuals (p. 896).

Barthes (1998a) proclaims the death of the monolithic author occurs in the act of writing (poesis). Modern concepts of author hinge upon beliefs of univocality and singularity of purpose and knowledge, yet Barthes writes “as soon as a fact is narrated no longer with a view to acting directly on reality but intransitively, that is to say finally outside of any function other than that of the very practice of the symbol itself, this disconnection occurs, the voice loses its origin, the author enters into his own death, writing begins” (p. 253). In one fell swoop, Barthes tears down the monolithic structure of autonomous author to reveal the character of writer as practicing a craft within a broad social milieu. The author for Barthes is a production of modern capitalist notions of liability and ownership and a positivist tyranny. The scripter and the text do not exist timelessly but in the here and now during and within the acts (praxis) of production and reading. The performance occurs in the moment of production and meaning takes shape in the process of reading, never decipherable to an exact essence of the text. Texts have no ultimate meaning tied to “God and his hypostases—reason, science, law” (p. 256). He claims that “Classic criticism has never paid any attention to the reader, for it, the writer is the only person in literature” (p. 257). The death of the modern concept of univocal and authoritative instructor/author gives birth to the active student/reader as both recipient and interpreter. The modern authorial, hierarchical stance also predicates discourse surrounding gender and space.

### **Boler, Massey, and Power Geometries**

At an AERA symposium last spring, Boler (2001) spoke on “Real and Virtual Gendered Identities in Educational Landscapes.” She writes, “The apparent ‘disembodiment’ created in cyber culture poses a genuine dilemma for feminist and socially-progressive educators” (p. 1). She declares that the phallogocentric conception that the body is central to the production of knowledge and the Platonic/Cartesian stipulation that the body needs to be transcended as an unclean and feminine entity corrupting knowledge and truth dominates discourses surrounding hypertextuality. She juxtaposes her skepticism of cyber culture’s claim to be a non-gendered, non-racial, anti-chauvinistic space with Massey’s (1993) critique of space anxiety and power geometries.

Massey (1993) in her “Power Geometry and a Progressive Sense of Place” refers to how localities are not as homogenous and local as they appear but are affected by power geometries of local heterogeneous values and global (extra-local) agencies:

The uniqueness of a place, or a locality, in other words is constructed out of particular interactions and mutual articulations of social relations, social processes, experiences and understandings, in a situation of co-presence, but where a large proportion of those relations, experiences and understandings are actually constructed on a far larger scale than what we happen to define for that moment as the place itself, whether that be a street, a region or a continent. Instead then, of thinking of places as areas with boundaries around, they can be imagined as articulated moments in networks of social relations and understandings (p. 66).

The preponderance of nostalgic spatial language is an aspect of power geometries in which hegemonic influences attempt to contain and limit the chaos supposedly non-spatial and extemporal cyber culture represents. Hegemonic groups use the time/space compression of cyber culture to further entrench the digital divide – women, non-whites, and poor people rarely find access to social and economic power-geometries that white, middle to upper class males do. Internet access alone does not guarantee access to power manifested within cyber culture space. While more women are accessing online spaces, they are often corralled into places that define them as feminine and marginalized from power. The most popular sites, such as girl chat rooms, traditionally gendered spaces like seventeen and cosmo -girl, and online shopping in gendered specified places, reify stereotypical feminine roles. Bolter (2001) concludes that “the nostalgia for place, authenticity, and stable identity which Massey recognizes as a masculine nostalgic reaction in relation to time -space compression accurately explains the reinscription of space in digital culture” (p. 4).

Traditional instructional design models tend to see classrooms (localities) as isolated places that exist somehow beyond the confines of a larger reality. Moreover, they regulate the social relationships among participants into strict hierarchies of power and limit networks to homogenous and hierarchical panopticons of power through knowledge transfer from information lords to information peons.

### **Systematic Instructional Design**

Often instructional designers and instructional technologists trained in the use of various modernist learning models, particularly Smith and Ragan (1993), Mager (1997), and Dick and Carey (1996), engineer course transformations from proximal to online. During these transformations, designers often imbue the course with modernist pedagogical assumptions by implementing one of the popular instructional design models. Traditional instructional design’s reliance on the privileged position of goals creates superordinate structures that circumscribe student activity and reinforce fixed domains of knowledge. Smith and Ragan (1993) write that

Instruction is the delivery of information and activities that facilitate learners’ attainment of intended, specific goals. In other words, instruction is the conduct of activities that are focused on learners learning specific things. . . . Every learning experience that is developed is focused toward a particular goal. (p. 2-3)

The student is passive and secondary to attainment of a goal he or she has no voice in choosing or manipulating to meet his or her needs and desires. The learner described in this quotation is a presumptive automaton ready for normalization that leads inexorably to a standardized product ready for the economic machine. We can easily see Bobbitt and Tyler’s philosophical assumptions playing in this statement. Moreover, teleological structures that emphasize regulation and particularization of fixed goals reify the power geometry of the designer’s privileged status at the expense of both the professor (denigrated to a content specialist) and the student (now little more than content assimilator). This dissemination into fixed roles, additionally, dehumanizes and regulates the process of learning.

Mager (1997) in his Preparing Instructional Objectives also designates objectives superordinate to the learner and methods as beyond the learner’s reach:

you must clearly specify outcomes or objectives you intend your instruction to accomplish. You must then select and arrange learning experiences for your students in accordance with the principles of learning and must evaluate student performance according to the objectives originally selected (p. 1).

The outcomes and methods belong to the instructional designer; Mager assumes student as recipient of content he or she has no choice and by methods in which he or she has no voice. Furthermore, only one set of learning principles seems to exist – in this case a form of reductive behaviorism. One can also note the frequent use of the imperative of his own instructional design. No room is given for any emergence, transaction, or adaptation to change that frequently happens in the emerging reality of the classroom: “instruction is only successful to the degree that it succeeds in changing students in desired ways” (p. 13). The presumption of student as automaton is naked here; moreover, the instructional designer defines success for the learner.

Arguably, the most popular instructional design model, often unquestioned as the instructional design model, is Dick and Carey’s (1996) The Systematic Design of Instruction. With its emphasis on being systematic, such hierarchical statements should not surprise one: “The first step in the model is to determine what it is that you want learners to be able to do when they have completed your instruction” (p. 5). While their belief in pedagogical ownership is not nearly as blatant as Mager’s (notably one of the theorists informing the design), the next quotation is telling in how little pedagogical freedom they afford the learner: “you will determine step-by-step what people are doing” (p. 5). Here the modern, mechanistic nature of systematic design is laid bare. Traditional instructional design clearly follows in the footsteps of Bobbitt and Tyler.

## Conclusion

To return to the plea for finding a means between extremes, we should consult Garrison's (1997) Dewey and Eros. Garrison, harking back to both classical Greek and Deweyian concepts of education, argues that modern education lacks eros, defined here as the passionate desire to achieve an ends. Clearly, the emphasis resides in relevance, but whose is a seemingly unsolvable conundrum in most modern, bureaucratic educational theorizing. Often we rely on dichotomies such as who comes first in choosing the curriculum: the student or the teacher? Do we pass off one person's desires as the only appropriate ones, which are typically cloaked as objective, value-neutral standards, or do we pander to students' desire without teacher guidance, much less supervision? If we, however, look for the common good, what we often call the teachable moment that is emergent and co-constructed, we can avoid this false dichotomy, this destructive either . . . or logic. In doing this, we must pay more than lip service to this noble goal.

In Curriculum as Conversation, Applebee (1996) states that often a discrepancy between "grand goals of exploration and discovery" unfolds and how the class is administered (p.21). If the teachable moment becomes a didactic game of "guess what I'm thinking" in which the teacher's knowledge or answer is more valuable than the student's, then we are lamentably back to a pedagogy of the oppressed cloaked by constructivist buzzwords. We are practicing pure reasoning, a deductive and self-enclosed quest for certainty, as opposed to practical reasoning that seeks ends we desire to obtain. The means, a constantly negotiated center within a fluid structure, exists somewhere between these extremes. The most appropriate way to accomplish this shift away from pedantic pedagogy is to accept students' voices as relevant within their educational trajectories. Regarding curriculum as conversation, Applebee writes,

Schooling should be organized to help students enter into culturally significant domains for conversation, themselves representative of broader cultural traditions of knowing and doing. By placing the emphasis on entry into such conversations, I seek to ensure that students will emerge with knowledge-in-action rather than knowledge-out-of-context (p. 49)

To do this we need to accept that knowledge is dynamic rather than static and that a means between student and teacher desires discerned through an emergent and mediated transaction will yield fluid and adaptive hyper-pedagogies.

## References

- Applebee, A. N. (1996). Curriculum as conversation: Transforming traditions of teaching and learning. Chicago: The University of Chicago Press.
- Ashcraft, M. H. (1994). Human memory and cognition (2<sup>nd</sup> ed.). New York: HarperCollins College Publishers.
- Barthes, R. (1998a). The death of the author. In D. H. Richter (Ed.). Falling into theory: Conflicting views on reading literature. Boston: Bedford/St. Martins.
- Barthes, R. (1998b). From work to text. In D. H. Richter (Ed.). The critical tradition: Classic texts and contemporary trends. (2<sup>nd</sup> ed.). Boston: Bedford Books.
- Barthes, R. (2000a). The structuralist activity. In C. Kaplan and W. D. Anderson (Eds.). Criticism: Major statements (4<sup>th</sup> ed.). New York: Bedford/St. Martins.
- Bobbitt, F. (1997). The curriculum. In D. J. Flinders & S. J. Thorton (Eds.). The curriculum studies reader. New York: Routledge.
- Becker, H. S. (1998). Tricks of the trade: How to think about your research while you are doing it. Chicago: University of Chicago Press.
- Boler, M. (2001, March). Real and Virtual Gendered Identities in Educational Landscapes. Symposium conducted at the meeting of the American Educational Research Association, Seattle, USA.
- Bowker, G. C. and Star, S. L. (1999). Sorting things out: Classification and its consequences. Cambridge, Massachusetts: The MIT Press.
- Carnochan, W. B. (1993). The battleground of the curriculum: Liberal education and American experience. Stanford: Stanford University Press.
- Derrida, J. (2000). Structure, sign, and play in the discourse of human sciences. In C. Kaplan and W. D. Anderson (Eds.). Criticism: Major statements (4<sup>th</sup> ed.). New York: Bedford/St. Martins.
- Derrida, J. (1996). Remarks on deconstruction and pragmatism. In C. Mouffe (Ed.). Deconstruction and pragmatism (S. Crichtley, Trans.). New York: Routledge.

- Descartes, R. (1993). Discourse on method and meditations on first philosophy (3<sup>rd</sup> ed.). (D. A. Cress, Trans.). Indianapolis, IN: Hackett Publishing Co.
- Dewey, J. (1944). Democracy and education: An introduction to the philosophy of education. New York: The Free Press.
- Dewey, J. (1997). Experience and education. New York: Touchstone.
- Downs-Gamble, M. (1996). "New pleasures prove": Evidence of dialectical disputation in early modern manuscript culture. Early Modern Literary Studies. 2 (2), 1-33.
- Dick, W. & Carey, C. (1996). The systematic design of instruction (4<sup>th</sup> ed.). New York: Longman.
- Eisner, E. (1994). The educational imagination: On the design and evaluation of school programs (3<sup>rd</sup> ed.). New York: MacMillan College Publishing Company.
- Eisner, E. (1997a). Educational goals—help or hindrance? In D. J. Flinders & S. J. Thorton (Eds.). The curriculum studies reader. New York: Routledge.
- Eisner, E. (1997b). Humanistic trends and the curriculum field. In D. J. Flinders & S. J. Thorton (Eds.). The curriculum studies reader. New York: Routledge.
- Eisner, E. (1997c). Who decides what schools teach? In D. J. Flinders & S. J. Thorton (Eds.). The curriculum studies reader. New York: Routledge.
- D. J. Flinders & S. J. Thorton (Eds.). The curriculum studies reader. New York: Routledge.
- Freire, P. (1973). Pedagogy of the oppressed (Myra Bergman Ramos, Trans.). New York: Seabury Press.
- Foucault, M. (1971). The order of things: An archeology of the human sciences (A. Sheridan, Trans.). New York: Pantheon Books.
- Foucault, M. (1979). Discipline and punish: The birth of the prison (A. Sheridan, Trans.). New York: Vintage Books.
- Foucault, M. (1997) What is an author? In D. H. Richter (Ed.). The critical tradition: Classic texts and contemporary trends (2<sup>nd</sup> ed.). Boston: Bedford Books.
- Gage, N. L. and David C. B. (1991) Educational psychology (5<sup>th</sup> ed.). Boston: Houghton Mifflin Co.
- Garrison, J. W. (1997). Dewey and eros: Wisdom and desire in the art of teaching. New York: Teachers College Press.
- Garrison, J. W. & Burton, J. K. (1995). Knowledge, power, and hypermedia. International journal of technology and design education 5, 69-87.
- Gress J. R. and Purpel, D. E. (1979). Curriculum: An Introduction to the Field. Berkeley, CA: McCutchan Publishing Corporation.
- Huxley, A. (1965). Brave new world revisited. New York: Harper.
- Latour, B. (1987). Science in action. Cambridge: Harvard University Press.
- Latour, B. (1994). On Technical Mediation—Philosophy, Sociology, Genealogy. Common Knowledge, 3 (2), 29-64.
- Landow, G. P. (2000). Hypertext: The convergence of contemporary critical theory and technology. In C. Kaplan and W. D. Anderson (Eds.). Criticism: Major statements (4<sup>th</sup> ed.). New York: Bedford/St. Martins.
- Kliebard, Herbert, M. (1979). The Tyler Rationale. In James R. Gress and David E. Purpel (eds.). Curriculum: An Introduction to the Field. Berkeley, CA: McCutchan Publishing Corporation, pp. 256-267.
- Mager, R. F. (1997). Preparing instructional objectives: A critical tool in the development of effective instruction (3<sup>rd</sup> ed.). Atlanta: Center for Effective Performance, Inc.
- Massey, Doreen. (1993). Mapping the futures: Local cultures, global changes B.J. Bird, G. Putnam, G. Robertson, & L. Tickner (Eds.). New York: Routledge.
- Plato. (1985). The republic (R. W. Sterling & W. C. Scott Trans.). New York: W. W. Norton & Co.
- Rousseau, J-J. (1962). Emile: selections (W. Boyd, Trans.). New York: Teachers College Press.
- Smith, P. L. and Ragan, T. J (1993). Instructional Design. New York: Merrill.
- Tyler, R. W. (1949). Basic principles of curriculum and instruction. Chicago: University of Chicago Press.
- Walker, D. F. & Soltis, J. F. (1997). Curriculum and aims (3<sup>rd</sup> ed.). New York: Teachers College Press.

## Designing Web Resource Learning Activities

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Web based instruction often fails to utilize its most unique capability, resources found on the web itself. All too often, lists of URLs are posted with the hope that somehow they will promote learning. Web resources are best utilized when appropriate learning activities are designed to make them an integral part of the learning process. Designing appropriate web resource learning activities requires an understanding of web resources and an application of basic instructional design principles.

The web offers an extensive collection of sites on nearly every topic. Some sites are outstanding, others mediocre at best. Some are interesting and engaging others dull and boring. Some sites are authoritative, others just plain inaccurate.

The first step in utilizing web resources is to find appropriate sites. An appropriate site should contain accurate information related to course content that can be incorporated into a learning activity. Finding good sites requires good searching techniques, discernment, and persistence.

One of the simplest web resource learning activities to help an instructor begin using web resources is a student site search activity. The goal of the activity is to have students find, describe, and share websites related to specified topics. Students will need to know web searching skills and how to evaluate websites. The assignment requires students to post an annotated link to the websites they find on an electronic discussion board. The activity will provide students with relevant course information and instructors with a list of potential websites for future web resource learning activities development.

Once a collection of appropriate web sites has been located, learning activities can be developed that utilize the sites effectively. Some sites provide context for course topics. Others provide good factual information. Some help with concept development, and others provide opportunities for students to analyze and synthesize information. From an instructional design perspective, websites can be thought of as existing materials that can be utilized to meet course outcomes. The key is to match the inherent characteristics of the site(s) to the types of learning activities needed to meet course outcomes.

In keeping with good instructional design, all web resource learning activities should have an introduction, an assignment, and links to the web sites for the activity. While each of these components is specifically tailored to each activity, there are some general characteristics. The introduction should provide context for the activity, motivational elements, and guidance for accomplishing the outcomes targeted by the activity. The assignment should be a natural by-product of utilizing the site that verifies participation in the activity. The links should be appropriate and durable.

A collection of interesting sites with a broad coverage of course topics can be used to create an information exploration activity that provides context for course topics. The introduction should explain how that the activity provides background and context for the main topics in the course. The assignment provides a means to insure that students complete the activity. It may be as simple as having them report on their findings, or it may require them to relate what they discovered to a key topic in the course. The web sites need to be engaging. They should appeal to student curiosity and be visually pleasing. Include sites on a wide range of supplemental topics. Each site should also have a broad coverage of topics on the site.

A knowledge acquisition activity is a good way to help students find important factual information for the course. The activity introduction should motivate students by explaining how the information is related to course outcomes, and that it is not just "busy work." Knowledge acquisition activities should include questions that focus on specific facts relevant to the topic at hand. The goal is to direct students toward the information they need to know about the topic. The assignment should require the students not only to have visited the sites to gather the facts, but also to utilize those facts to accomplish the assigned task. The sites for the activity must contain the factual information necessary to answer the topic-related questions. Look for sites that focus on the topic and provide information not included on other sites. Try to cover the topic with a minimal number of sites.

Web sites often provide the examples necessary for a concept development activity. The introduction to the activity should focus on the key elements of the concept being learned. The assignment should provide the students with an opportunity to demonstrate that they have a clear grasp of the concept. Several sites that clearly demonstrate the attributes of the concept or that are obvious non-examples of the concept should be used.

A knowledge generation exercise directs students to sites containing information related to a specific course topic. The assignment in the exercise requires that the students analyze the information they find. They are

then required to synthesize that information and generate a new representation of that knowledge. Knowledge generation forces students into inquiry and higher order thinking. It is often appropriate to utilize collaboration between students to provide multiple points of view. The activity introduction should arouse the natural curiosity of students by focusing on the controversial or challenging aspects of the activity. The assignment should provide the students with the opportunity to create a document, presentation, or other means of communicating the ideas they have generated from the information they have learned. Look for sites with divergent opinions about the topic that force students to think critically. Provide enough sites to present all of the major aspects of the topic.

Web resources can provide effective learning activities. Appropriate selection, design, and utilization will optimize the use of those resources and make them an important part of your course.

## **LEARNING AT A DISTANCE in South Dakota: Description and Evaluation of the Diffusion of a Distance Education**

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### **Background: Distance Education in South Dakota**

The fall of 2000 has brought broad new opportunities to K-12 education in South Dakota. Beginning on August 15, 2000 interactive videoconferencing classes began to be sent over the Digital Dakota Network (DDN), a state-wide telecommunications network connecting all 176 school districts in the state. The DDN provides schools with free Internet, videoconferencing and e-mail. Although the DDN and statewide videoconferencing is new to South Dakota, regional video conferencing within the state is not.

As early as 1994 classes were offered over the North Central Area Interconnect (NCAI), a video consortium of eight schools in the northeast part of South Dakota. An advisory committee made up of one principal from each district advises the governing board of the NCAI. The governing board who actually makes the decisions is composed of a superintendent from each district. It is estimated that the original development of the NCAI system cost \$1.3 million. A portion of the funding came from a Rural Electrification Administration grant with the member districts providing the remainder of the startup costs. Member schools presently pay \$11,000 a year membership fee and educators teaching over the system are given a \$450 stipend a semester.

Early class offerings on the NCAI included Spanish and Lakota Indian Art. NCAI has continued to expand their course offerings to students and by the spring of 2000, NCAI was in a situation where they were contemplating adding an additional videoconferencing classroom to meet their student curricular needs.

Lloyd Trautman, a physics teacher on the NCAI, and his wife, a Spanish teacher over the network, have been teaching on the system since the first year. Lloyd was among distance education's harshest critics when the NCAI started. Today Lloyd is one of distance education's strongest advocates in the state because of his experience and the benefits of distance education that he has seen firsthand. In a school with an enrollment of 100 students in grades K-12, distance education has met a variety of needs that would never have been possible. The NCAI schools have experienced the benefits of distance education

A second video consortium, the Sanborn Interactive Video Network (SIVN), began offering classes in January of 1996. This consortium of six K-12 schools, a private university, and a technical institute, utilized a Rural Utilities Services (RUS) grant to fund a portion of the startup costs to establish their network. Member schools pay \$3,000 a year for maintenance and administration of the system. A \$400 stipend is paid to individuals teaching a course over the network. The SIVN presently offers seven classes over the system and has seen an increase in participation each year. More information on the SIVN can be found at: <http://mti.tec.sd.us/teleport/sivn.htm>

The Southeast Interactive Long Distance Learning (SILDLD) started offering classes in the fall of 1998 to its 11 member schools in the southeast corner of the state. A portion of this million-dollar system was paid for by a RUS grant. Members pay \$3,000 a year to cover administration of the system and pay a \$500 stipend to educators that teach over the system.

The SILDLD started with 9 classes and 100 students and within two years is offering 15 classes to 225 students. This consortium has also been in a position of needing to add a second video classroom to cover the demands of the member schools. The principals and superintendents of the member schools have regular meetings where they indicate which classes they are able to offer and which classes they need. Additional information on the SILDLD can be found at their website: [www.usd.edu/sildl](http://www.usd.edu/sildl).

A fourth video consortium, the East Central Interconnect (ECI), started classes in the fall of 1999. The ECI received a RUS grant which provided a strong start for the funding of this million-dollar system. Teachers on the ECI are paid a \$600 stipend per semester of teaching. A school board member from each of the 10 member schools governs the ECI. They receive advice from two advisory groups of representative superintendents and principals. The ECI offered nine classes to 119 students its' first year and eight classes to 131 students during the 2000-2001 school year.

All four of these consortiums provide their teachers with training on equipment and strategies on teaching at a distance. Each has developed policies that govern the activities of each consortium. All have felt that their choice to try videoconferencing as a means of distance education for their students was a wise decision and investment.



Additional initiatives by other districts have also occurred. Two consortia of K-12 schools are in the planning stages of implementing a video network. Two independent school districts have also purchased video conferencing equipment which they have used over the last two years to connect their students with resources inside and outside the state.

In 1994 a satellite network, the Rural Development Telecommunications Network (RDTN), was established across the state. It consists of 18 two-way audio/video studios located throughout the state at universities and technical institutes. In addition, 80 downlink sites located primarily at school districts were connected to the RDTN. These sites have one way video/two-way audio. Use of the RDTN network is on a fee per use basis. The RDTN has provided South Dakota citizens with the opportunity to experience the opportunities that a two-way audio/video system can provide a large geographic region like a state.

This network has been used widely by government, education, and health organizations to provide information and training. The RDTN satellite downlinks have also provided a vehicle for several rural schools in the state to receive high school Spanish and Chemistry. Many districts have taken advantage of these classes which they would otherwise not been able to offer their students.

Distance education at the higher education level in the state began in 1914 at South Dakota State University with extension activities, and in 1915 the University of South Dakota began offering correspondence courses. The six state universities have taken advantage of the two-way audio/ one-way video capabilities of the RDTN to offer courses to college level students and to offer dual credit to high school students.

More recently, Governor William Janklow allocated funds to each of the five state universities to establish a "smart classroom" or a Governor's Electronic Classroom (GEC). Each classroom contained individual computer workstations and video conferencing equipment. The GECs provided high tech classrooms for universities to provide instruction at distance.

On July 1, 2000, the Electronic University Consortium (EUC) of South Dakota officially began operation. This consortium is intended to leverage the state's technology investments and make effective use of the unique strengths of each public university to better serve the people of South Dakota by coordinating off-campus distance education across the South Dakota System of Public Higher Education. This consortium was made possible through legislative action during the 2000 session which made funding available for staff to coordinate the consortium's activities.

In the fall of 2000, the higher education institutions in the state are offering distance learning opportunities via the internet, satellite, videocassette, public television, and correspondence. With over 700 South Dakota college students enrolled in multiple institutions within the state taking distance education courses during the fall 2000 semester, the face of higher education in the state is also changing.

Since 1995 Governor William Janklow has slowly and very carefully built a robust technical infrastructure across the state of South Dakota. In 1995 he initiated the Wiring the Schools (WTS) project which put three computer drops for every four students in every classroom, pulled Cat5 and fiber optic wiring throughout the schools, and upgraded the electrical wiring to manage the greater electrical demands of numerous computers. (See accompanying article regarding WTS.) The work of WTS included all public school classrooms, private schools, public libraries, and both public and private university classrooms and dormitories.

In the spring of 1999 Governor Janklow announced a second statewide initiative, Connecting the Schools (CTS). This initiative built a statewide intranet among all 176 school districts bringing T1 access into every public school building K-12. High-end two-way audio/video systems were put into almost every public high school and freestanding middle school. (See related article on CTS.) The Connecting the Schools project built upon the efforts of Wiring the Schools project, establishing a statewide network called the Digital Dakota Network (DDN). The Internet access and e-mail services provided via the DDN are free to all public schools. Video conferencing connections made within the state are also provided free to all schools.

Even though a huge investment has been made in the infrastructure of the DDN, Governor Janklow has always recognized the necessity of developing human infrastructure as well. During the 2000 session, the South Dakota Legislature created a new office within Department of Education and Cultural Affairs called the Office of Educational Technology. According to Section 4 of House Bill 1257, the Office of Educational Technology's "exclusive role shall be assisting local school districts in using educational technology. Its purpose shall include researching, analyzing, procuring, and distributing programs and methods using educational technology in South Dakota K-12 schools and classrooms." The office consists of a program manager, four technology integration specialists, the Department webmaster, and clerical support. The technology integration specialists provide direct assistance to districts and individual teachers on the use of the videoconferencing equipment and instructional strategies. The assistance these specialists have and will provide districts will be one of the keys to the successful utilization of the DDN.

In addition to the technical assistance provided to schools, quality, long-term professional development was also provided. In the summer of 2000 a Distance Teaching and Learning (DTL) Academy was made available to South Dakota educators. This academy was modeled after the Technology for Teaching and Learning (TTL) Academies already implemented in the state (see related TTL article).

Two sessions of this three-week academy were held at a state university with about 130 teachers in attendance. Participants focused on the basics of operating the video conferencing equipment and adapting curriculum for distance delivery. (See related article on the DTL Academies.) With six of the VTEL LC5000s bridged together during the academy, participants were able to practice in a "live" situation. This academy has follow-up opportunities for participants throughout the school year utilizing the DDN's videoconferencing capabilities. Subsequent DTL Academies are being planned so that they are delivered during the summer at school district locations utilizing the powerful capabilities of the DDN. Daily virtual guest speakers who are experts in the field of distance education will be brought to all the academy locations via videoconferencing on the network.

Recognizing that others across the nation have developed expertise in distance education, Governor Janklow wanted to capitalize on those learnings. During July of 2000 the Governor convened his first "Governor Janklow's Capital City Conclave on Distance Education" for which he invited 12 national leaders in distance education to the state capitol for two days to discuss the issues and potential of distance education for a rural state like South Dakota. (See accompanying Conclave article for agenda and participant information.) United State's Senator Tom Daschle was a virtual guest of the Conclave, addressing participants via videoconference from Washington D.C.

In addition to the national guests, the Governor invited 40 state leaders to be a part of the Conclave discussion. It was important that leaders from various state constituencies understand the advantages and potential of a statewide videoconferencing network. The Governor gathered input from these ambassadors on possible next steps for the state. Follow-up with these ambassadors is planned.

Recognizing that the DDN will cause a greater demand for technically skilled people to maintain the network, the Governor has campaigned heavily to make Cisco Networking Academies available in most school districts. During the first year of this effort, 32 Cisco labs have begun to offer networking coursework to junior and senior high school students. Funding for some of these labs has been made possible through the State's Department of Labor. Additional school districts are being encouraged to apply for funding to obtain their own Cisco labs building capacity throughout the state.

Through the efforts of many, led by a very committed Governor, South Dakota is in a position to provide distance education opportunities to every community and citizen in the state. The robust Internet connections and video conferencing capabilities provided by the DDN make many distance learning options available to South Dakota learners. Quality professional development and technical assistance to schools will further encourage the appropriate and effective uses of the DDN to expand learning opportunities across the state.

### **Evaluation: Distance Education and South Dakota**

"In order to plow straight rows, the farmer does not look down at the ground but at the end of the field."

One major component of the efforts to promote the use of technology and distance education in South Dakota and specifically of Phase III of the *Connecting the Schools Project* was a comprehensive evaluation activity. The process of evaluation included active participation in the project by evaluators, collection of quantitative and qualitative data and submission of several comprehensive evaluation reports. A baseline report was completed and published in March of 2000. This baseline report established a foundation for subsequent evaluation activities. A second report included data collected since the baseline report.

The overall evaluation plan was built around the AEIOU approach (Fortune & Keith, 1992; Sweeney 1995; Sorensen, 1996). The effectiveness of this approach has been demonstrated during its use evaluating the activities of the Iowa Distance Education Alliance, Iowa's Star Schools Project (Simonson, 1995; Sorensen & Sweeney, 1994), a multi-year state-wide distance education activity. Additionally, the model has been used to evaluate a number of other innovative projects such as the Iowa Chemistry Education Alliance (1995), the Iowa General Chemistry Network (1994), and the DaVinci Project: Interactive Multimedia for Art and Chemistry (Simonson & Schlosser, 1995).

The AEIOU evaluation process provides a framework for identifying key questions related to the project's implementation. The AEIOU model is a dynamic one that permits the professional to tailor the process of evaluation to the specific situation being studied. This approach has five components that permit examination of the Phase III of the *Connecting the Schools Project* from a number of different perspectives.

Component 1 - **Accountability** - Did the project planners do what they said they were going to do?

This is the first step in determining the effectiveness of the project and is targeted at determining if the project's objectives and activities were completed. Evaluation questions center on the completion of specific activities. Additionally, counts of numbers of people, things, and activities are collected.

Methods Used: Accountability information was collected from project administrative records. Project leaders were asked to provide documentation of the level of completion of each of the projects goals, objectives, and activities.

Component 2 - **Effectiveness** - How well done was the project?

This component of the evaluation process attempts to place some value on the project's activities. Effectiveness questions focused on participant attitudes and knowledge. Evaluations were used to collect reactions from participants of workshops, academies, and other project activities.

Methods Used: Standardized measures are used to determine program effectiveness. Teachers are asked questions related perceptions about the appropriateness of the *CTS Project*. Focus groups were conducted and participants were systematically asked to respond to questions about the project.

Component 3 - **Impact** - Did the project make a difference?

During this phase of the evaluation, questions focused on identifying the changes that resulted from the project's activities, and were tied to the stated outcomes of the project. In other words, if the project had not happened what of importance would not have occurred? A key element will be the collection of longitudinal data at the beginning, middle, and end of the project.

Impact is extremely difficult to determine because determinants of impact vary. Data were collected at the beginning of the project, during its implementation, and at the end of the first full year of activity.

Methods Used: Qualitative measures such as interviews, focus groups, and direct observations will be used to identify the project's impact.

Component 4 - **Organizational Context** - What structures, policies, or events in the organization or environment helped or hindered the project in accomplishing its goals?

The focus of this component of the evaluation was on identifying those contextual or environmental factors that contributed to, or detracted from, the project.

Methods Used: Organizational context evaluation used interviews of key personnel, focus groups made up of those impacted by the program, and document analysis that identified policies and procedures that influenced the program. Direct participation in program activities by the evaluator also permitted direct observation of events.

Component 5 - **Unanticipated Consequences** - What changes or consequences of importance happened as a result of the project that were not expected?

This component of the AEIOU approach identifies unexpected changes of either a positive or negative nature that occurred as a direct or indirect result of the project. Unanticipated consequences are a rich source of information about why some projects are successful and others are not. Central to the measurement of unanticipated outcomes is the collection of ex post facto data.

Methods Used: Interviews, focus groups, journals, and surveys that asked for narrative information were used to identify interesting and potentially important consequences of implementing the *CTS Project*. Evaluators interacted with project participants on a regular basis to learn about the little successes and failures that less sensitive procedures overlook. Active and continuous involvement by evaluators permitted them to learn about the project as it occurs

## **DIFFUSION OF INNOVATIONS**

Distance education is a new idea in South Dakota. More accurately, distance education is an innovation in South Dakota. Distance education is defined as:

*Institution-based formal education where the learning group is separated and where telecommunications technologies are used to connect learners, resources, and instructors* (Simonson, et. al., 2000, p. 10)

Specifically, in South Dakota distance education uses a technology -- compressed video -- that permits two or more sites to connect to one another for the synchronous sharing of video and audio. Compressed video is a television technology that has traditionally been used in corporate training, but increasingly is being used in K-12 education. Live, two-way video based instruction is a main strength of compressed video. In 2000, compressed video is considered by most to be an innovation.

An innovation is an idea, practice or object that is perceived as new. Innovations are introduced into organizations and either are adopted or rejected (Rogers, 1995). This process is called diffusion. Diffusion of an

innovation is the process of communication through certain channels over time among the members of a social system. There are four main elements of diffusion:

### **Innovation**

An idea, practice or object that is perceived as new by an individual or other unit of adoption.

### **Communication Channels**

Process by which participants create and share information with one another in order to reach a mutual understanding.

### **Time**

Dimension in the innovation-decision process by which an individual passes from first knowledge of an innovation through its adoption or rejection.

Relative earliness/lateness with which an innovation is adopted.

Rate of adoption – number of members of the system that adopt the innovation in a given time period.

### **Social system**

A set of interrelated units that are engaged in joint problem solving to accomplish a common goal.

With a technology innovation, such as distance education, there are two components: (1) Hardware: defined as the tool that embodies the technology as a physical object and, (2) software, consisting of the knowledge base for the tool. The characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption (Rogers, 1995). The five attributes of an innovation are:

1. *Relative advantage* is the degree to which an innovation is perceived as better than the idea it supersedes. The degree of relative advantage may be measured in economic terms, but social prestige, convenience, and satisfaction are also important factors. It does not matter so much if an innovation has a great deal of objective advantage. What does matter is whether an individual perceives the innovation as advantageous. The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption will be.
2. *Compatibility* is the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters. An idea that is incompatible with the values and norms of a social system will not be adopted as rapidly as an innovation that is compatible. The adoption of an incompatible innovation often requires the prior adoption of a new value system, and this is a relatively slow process.
3. *Complexity* is the degree to which an innovation is perceived as difficult to understand and use. Most members of a social system readily understand some innovations; others are more complicated and will be adopted more slowly. New ideas that are simpler to understand are adopted more rapidly than innovations that require the adopter to develop new skills and understandings.
4. *Trialability* is the degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the installment plan will generally be adopted more quickly than innovations that are not divisible. Ryan and Gross (1943) found that every one of their Iowa farmer respondents adopted hybrid seed corn by first trying it on a partial basis. If the new seed could not have been sampled experimentally, its rate of adoption would have been much slower. An innovation that is trialable represents less uncertainty to the individual who is considering it for adoption, as it is possible to learn by doing.
5. *Observability* is the degree to which the results of an innovation are visible to others. The easier it is for individuals to see the results of an innovation, the more likely they are to adopt it. Such visibility stimulates peer discussion of a new idea, as friends and neighbors of an adopter often request innovation-evaluation information about it. Solar panel adopters often are found in neighborhoods in California, with three or four adopters located on the same block. Other consumer innovations like home computers are relatively less observable, and thus diffuse more slowly.

In South Dakota, distance education using compressed video is an innovation that is being introduced into the state. The success or failure of this innovation will largely depend on the process of diffusion that occurs. Diffusion of innovations sometimes occurs naturally, without the need for outside intervention. Often however,

diffusion is managed and facilitated by change agents who involve opinion leaders who provide the necessary impetus for an innovation to reach what is called critical mass. Critical mass is the point at which an innovation spreads and expands without the need for outside intervention.

In South Dakota, the change agents who are guiding the spread of distance education are a group of educational leaders and state department staff. This group identified opinion leaders and trained and oriented them through the use of workshops and academies. The group of opinion leaders has and will provide instruction and support to South Dakota teachers who in turn will guide children and young adults to successfully use the innovation of distance education.

In summary, the diffusion of distance education in South Dakota schools is a process involving an innovation (DDN; compressed video), using communication channels (Workshops and Distance Teaching and Learning Academies), over time, within a social system (the educational community of South Dakota). The evaluation activities described next were conducted to provide educational leaders (change agents) with information to assist them in reaching critical mass, the point at which distance education is widely accepted.

## EVALUATION ACTIVITIES AND RESULTS

The goal of this evaluation effort is to provide leaders in the state of South Dakota with quantitative and qualitative evaluation information about the implementation of the distance learning infrastructure phase of the Connecting the Schools project. Evaluation focused on the analysis of the relationship between the distance education training and diffusion of the distance education innovation into the K-12 environment. Factors that were of special interest to the evaluation included information about the innovativeness of those individuals involved in distance education in South Dakota, and the innovativeness of educational organizations in the state. This information helped to explain why educators and organizations were accepting or rejecting distance education, and provided insight into how the process of diffusion of this innovation can be facilitated.

### Evaluation Activities

The following activities were part of the South Dakota evaluation plan. First, a standardized questionnaire, called the Connecting the Schools Questionnaire (CSQ) was systematically developed. This questionnaire included four sections – demographic information, a measure of personal innovativeness, and measure of organizational innovativeness, and questions related to distance education.

Second, the CSQ was administered to participants in six workshops for opinion leaders that were held for educators to provide them with skills and knowledge related to distance education. Staff from the Department of Education and Cultural Affairs (DECA) conducted these workshops. In addition to completing the CSQ, participants at these workshops had the opportunity to respond to open-ended questions. These questions were included in the evaluation to give workshop participants the opportunity to express their opinions about distance education.

Third, participants at Technology Teaching and Learning (TTL) Academies and Distance Teaching and Learning (DTL) Academies were asked to complete the CSQ. For these groups the CSQ was made available in an on-line version, so they could respond via the Internet. The participants at the TTL and DTL Academies also had the opportunity to give open-ended statements. Additionally, a modified focus group activity was conducted with participants of one of the DTL academies. Attendees were asked to respond to three questions about distance education in the state.

Finally, a random selection of South Dakota teachers was sent the CSQ. Their responses provide a basis of comparison. They represent the “average” South Dakota educator. This group also provided open-ended comments about technology and distance education.

### Conclusions

Based on the results collected from the CSQ and from focus group activities the following conclusions about South Dakota’s *Connecting the Schools – Phase III* Project can be made.

Component 1: **Accountability** – Did the project planners do what they said they were going to do?

It is obvious from data collected, meetings attended, and reports submitted that the *Connecting the Schools Project – Phase III* is being conducted effectively. Distance Teaching and Learning (DTL) Academies were held during the summer, as were six specialized training sessions for opinion leaders. Additionally, a number of meetings, short sessions, and orientations were held, all designed to explain the potential of distance education and the utilization of the Digital Dakota Network.

**Component 2 - Effectiveness** – Will the project be done well?

The effectiveness of the project was measured by the responses from teachers, administrators, network specialists, grant administrators and DECA employees to the training offered, utilizing standardized measures. Questionnaires were given to participants in workshops, and focus groups were conducted with participants.

It is apparent from observations made, data collected, and discussions held that the initial activities of the *CTS – Phase III* project were considered to be effective by participants and leaders. It is obvious that the vast majority of those involved believed that what they were participating in was effective. There has been an interesting lack of criticism of the *CTS project*, even though there have been numerous concerns expressed how distance education will impact on the South Dakota educational community and how overworked educators will be able to effectively adopt this innovation. Apparently, most think the CTS is an effective plan to alleviate concerns about distance education.

**Component 3 – Impact** – Will the project make a difference?

By far the most difficult evaluation concept to ascertain, especially in the short term, is the impact of any project, program, or innovation. Impact can be determined when baseline data are compared to data collected in a year, three years, and five years. Data collected and reported early in a project such as this one establish a framework for determining the intermediate and long-term impact of distance education generally, and more specifically, the DDN with its compressed video classrooms. Of critical importance to determining impact is the evaluation of the diffusion process followed by the educational leaders who manage distance education in the state.

It appears that the impact of the *Connecting the Schools Project – Phase III* has been positive. There is a notable lack criticism of the project; most likely because of the carefully planned, systematic process followed by project leaders. It is important to call attention to the success of process used to diffuse distance education into the educational system of South Dakota. First, opinion leaders were identified and specialized training in workshops was developed for them. Second, a large number of teachers were invited to the DTL Academies where they participated in instruction that was comprehensive, lengthy, and conducted by opinion leaders. DTL Academy graduates became highly knowledgeable and many became committed to the potential positive impact of distance education. Finally, stakeholders outside of the educational community were targeted for information about distance education and the DDN. These efforts broadened understanding in the general community and helped diffuse the innovation.

**Component 4 – Organizational Context** – are the structures, policies, or events in place that will help the project in accomplishing its goals?

Preliminary evaluation results clearly show that the concept of organizational context is critical to the success of the *CTS – Phase III* project. Specifically, these organizational topics have been identified:

Teachers must have staff development to overcome their fear of the innovation.

Teachers need continued support after staff development.

Educational policies that guide school policy will need to be studied and changed where necessary.

Teacher (and by implication, parent and student) fears and concerns will need to be addressed in a systematic and planned manner in order for distance education and the DDN to be widely accepted.

Information collected in focus group sessions provided considerable information concerning organizational context. First, there was reported a high level of general support for distance education, specifically because of the potential for curriculum enhancement. Second, many South Dakota educators said they were fearful of the consequences of distance education. Many groups reported these fears over a number of focus group activities. The fear or apprehension felt by those who must ultimately adopt an innovation such as distance education must be dealt with. It appears that the lengthy training provided in the DTL Academies is an excellent technique that alleviates apprehension. Continued follow-up activities with educators are necessary.

**Component 5 – Unanticipated Consequences**

A number of unanticipated activities occurred – the most significant was a special meeting held in Pierre, SD in July. This meeting, Governor Janklow's Capital City Conclave on Distance Education, brought a dozen national and international experts in distance education to South Dakota to interact with state leaders. Also, there seems to be a level of leadership being provided by staff (change agents) from the Department of Education and Cultural Affairs (DECA) that was not apparent when this evaluation began. This leadership seems to transcend the *CTS Project*. While leadership is difficult to document, many comments from South Dakota educators summarized in this report refer to the positive influence of DECA staff.

It is obvious that the *CTS – Phase III* project's activities have been accountable, and that early indications are that they have been effective in meeting stated objectives. The impact of the project's initial activities will be determined over time. Baseline information has been collected and will permit a clearer determination of impact in subsequent reports and in future years.

It is clear from information collected that the organizational context in which distance education exists in South Dakota is evolving, as it should, and that additional changes will need to be considered. Finally, it seems that a number of new and potentially important activities are being considered that were not anticipated when the *CTS Project* was planned. This is to be expected and is considered by most evaluators as an indication of effectiveness.

Significant suggestions identified as a result of evaluation of the diffusion of distance education in South Dakota include the following:

- Many of the participants of the six special workshops held during the spring and summer of 2000 were selected because they were considered to be opinion leaders. The data support that many opinion leaders did attend these workshops.
- A large number of the participants of the Distance Teaching and Learning (DTL) and Technology for Teaching and Learning (TTL) Academies had relatively low levels of personal innovativeness.
- Classroom teachers are the group most emulated by workshop attendees, TTL/DTL attendees and South Dakota teachers, in general. Classroom teachers are a group that increasingly should be used as opinion leaders. This will speed the diffusion of distance education in South Dakota.
- The process of using change agents to orient opinion leaders who in turn work with teachers and other adopters is a good one that seems to be working effectively in the state.
- Trialability and observability have been recognized as critical to the adoption of distance education in South Dakota. Trialability and observability opportunities should be increased in number and location to speed the adoption of distance education.
- An increased number of TTL/DTL attendees are likely to have relatively low levels of personal innovativeness indicating a reluctance to adopt distance education. A different strategy for providing staff development to these educators should be considered. Specifically, individuals with strong reluctance to adopt an innovation can not be easily influenced by normal diffusion strategies (Rogers, 1995). Rather, most efforts should be directed at educators with higher levels of innovativeness towards distance education. This is not to suggest that those with low levels of innovativeness should be ignored. Instead, efforts should be focused on other, more innovative educators.
- According to the data collected, younger, highly educated South Dakota teachers are a group that should be used to provide leadership for the adoption of distance education in the state.
- Continued support of teachers who adopt or are considering the adoption of distance education after the DTL Academy experience should be available. Mini-grants, short workshops, visits by Department of Education and Cultural Affairs staff, and publicity for projects are examples of ways to provide continued support for educators who are using the DDN and distance education.

In summary, the strategy developed to diffuse distance education into the educational community of South Dakota appears to be an approach to be modeled by other states and regions that are interested in developing a large distance education system.

First, change agents working for the Department of Education and Cultural Affairs were used to provide training and support for educators emulated by their peers. These groups received special attention in workshops designed expressly for them. These educators were considered to be opinion leaders; individuals looked to by their peers as persons to respect. Next, a large number of educators were given in-depth staff development in lengthy Distance Teaching and Learning Academies. Finally, the trained educators returned to their local schools and communities where they were supported by staff from the state department of education in efforts to use the Digital Dakota Network for distance education. The process of diffusion of the innovation of distance education was research and theory based (Rogers, 1995), evaluated systematically (AEIOU Approach), and dynamic so changes could be quickly implemented to respond to unanticipated events. In South Dakota, Daniel Burnham's famous statement is the watchword.

“Make no little plans; they have no magic to stir the blood!”

## REFERENCES

- Fortune, J., & Keith, P. (1992). *Program evaluation for Buchanan County Even Start*. Blacksburg, VA: College of Education, Virginia Polytechnic Institute and State University.
- Hurt, H., Joseph, K., & Cook, C. (1977). Scales for the measurement of innovativeness. *Human Communications Research*, 4(1), 58-65.

- Hurt, H., & Teigen, C. (1977). The development of a measure of perceived organizational innovativeness. *Communication Yearbook I* (377-385). New Brunswick, NJ: International Communications Association
- Huxley, E. (1982). *The flame trees of Thika; memories of an African Childhood*. London: Chatto and Windus.
- Rogers, E. (1995). *Diffusion of innovations, 4<sup>th</sup> Ed.* New York: Free Press.
- Ryan B. & Gross, N. (1943). The diffusion of hybrid seed corn in two Iowa communities, *Rural Sociology*, 8:15-24.
- Simonson, M. (2000). *Teaching and learning at a distance: Foundations of distance education*. Columbus, OH: Prentice-Hall.
- Simonson, M. (2000). Personal innovativeness, perceived organizational innovativeness, and computer anxiety: Updated scales. *Quarterly Review of Distance Education*, 1(1). 69-74.
- Sorensen, C. (1996). *Final evaluation report: Iowa distance education alliance*. Ames, IA: Research Institute for Studies in Education.
- Sweeney, J. (1995). *Vision 2020: Evaluation report*. Ames, IA: Research Institute for Studies in Education.



# Student-governed electronic portfolios as a tool to involve university teachers in competency-oriented curriculum development

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## Abstract

*At the University of Twente a new curriculum on educational science and technology has been introduced. That occasion was used to try to develop an apprenticeship model in which the students are regarded as young professionals from the very beginning. In that model the students are expected to govern their professional growth by actively collecting evidence of acquired competencies in electronic portfolios. This activity should stimulate teachers to adapt their teaching style to the requests from students for feedback on products that the students would like to put into their portfolios. After three iterations of development in three consecutive academic years, however, the use of portfolios is still not successful. The reasons why are discussed and steps to be taken are suggested.*

## The Project

The Faculty of Educational Science and Technology at the University of Twente in the Netherlands is educating educational designers with specializations in seven directions: curriculum development, instructional technology, instrumentation (media, computers, and internet in education), educational organization and management, Human Resources Development (HRD), educational testing, and social science research. The Faculty intends to switch to a competency-oriented curriculum for its three-year Bachelor program.

The term 'competency' is partly to be understood in terms of the knowledge and skills that comprise the competency profile of a profession and partly as the ability "...to operate in ill-defined and ever-changing environments, to deal with non-routine and abstract work processes, to handle decisions and responsibilities, to work in groups, to understand dynamic systems, and to operate within expanding geographical and time horizons" (Keen, 1992). Knowledge and skills can be assessed in traditional ways. The kind of behavior as described by Keen is more difficult to observe. This at the same time causes a problem in terms of the extent to which competency in Keen's terms should dominate the whole philosophy and organization of the program. To get around this problem, competency development was seen as an activity that can take place in concert with doing traditional coursework, as long as the students would be able to handle the related learning experiences from a meta-cognitive level that complies with Keen's definition of competent behavior.

The use of portfolios offers a possibility to build evidence of the development of competencies. The main attraction of portfolios is formed by its potential to assess progress and process as essentials for learning (Saywer, 1994). In the new curriculum portfolios are introduced for self-assessment by the students as well as for monitoring their progress.

Starting in the academic year 1999, electronic portfolios were introduced to provide students with a tool for actively working on competency development. The introduction was monitored and the use of the portfolios was developed in a few steps aiming at answering the following question:

"Do student portfolios yield sufficient support to help students to direct their own development in a competency-oriented curriculum, and if so, under what conditions?"

The literature shows growing consensus that educational reform efforts are doomed to fail unless the teachers' cognitions, including their beliefs, intentions, and attitudes, are taken into account (Haney, Czerniak, & Lumpe, 1996). The introduction of student portfolios is not only planned to serve the purpose of the students, but also as a tool for the implementation of the new curriculum. The latter relates to the readiness and willingness of teachers to adopt a new approach, for which the following question should be answered:

"Does student-directed collection of evidence of professional growth influence teaching style of academic staff?"

## **The educational concept "initiation in the academic profession"**

The new curriculum approach is based on a concept that is labeled: "initiation in the academic profession" (Verhagen, 2000). It is an apprenticeship model in which the students who enter the university directly from secondary school are regarded as young colleagues from the very beginning. A central principle of the concept is that the interaction between students and teachers should take place in a professional context as much as possible instead of interaction in an instructional context. Assignments should as much as possible mirror professional practice to help students to develop professional behavior. The result of a literature assignment should take the form of the literature part of a scientific article; communication products of design assignments such as proposals, budget estimates, blueprints or evaluation reports should take a form that would be appropriate to present to clients; and so forth. Teachers should primarily be regarded as experts who enable the development of academic insights by scientific discourse.

To make this work, a new approach of mentorship has been introduced together with the new curriculum. Each student becomes a member of a mentor group that is chaired by a staff member of the faculty. A mentor group consists of about 12 students from all three years of the Bachelor program, about four students from each generation. The mentor groups provide a social structure in which the master (the mentor/staff member) and the experienced students from the second and third year help the first year students (the learners) to be initiated in the professional culture of academic professionals. In these groups the discussion of personal development towards becoming a competent professional is a standing issue. The group members are required to collect evidence of professional growth that lends itself for discussion with the mentor and in the mentor groups.

The students collect the evidence of their professional development in their electronic portfolios. Each portfolio consists of four parts: (a) An introduction of the owner (student), (b) a text based curriculum vitae, where the student is expected to put personal information, information about his or her school career, information concerning professional development in or outside of the official program (like having a job in the field) and other information such as involvement in sports and hobbies; (c) an archive, where the student puts evidence of his or her professional development during the study; and (d) a showcase where the student chooses to present a selection of his or her best work. The archive is the central tool for the student to perform self-assessments about specific accomplishments as well as to reflect on personal development in general. Self assessment is considered to be a form of metacognition that is essential for self-regulation (Simon & Forgette-Giroux, 2000).

Additional features of the new curriculum are that the development of information and communication skills is integrated into courses and that all courses are organized using a Web-based course management system (TeleTOP, a home-made Lotus Domino application).

The implementation of the new approach requires a substantial change of teacher behavior. Most teachers are used to teacher-controlled instructional formats. Some teachers, however, share the philosophy of the new curriculum concept. They should act as the pioneers and early adopters who provide a critical mass of authentic professional tasks that allow student to develop the necessary skills for self-regulation of their academic education. These tasks and the interaction in the mentor groups are expected to shape the attitude and abilities of the student into characteristics of self-reliant young professionals. The extent to which this will appear to be true will answer the first research question.

Approaching the students in such a way that they perceive the need to adopt a professional attitude is expected to cause students to work conscientiously on compiling evidence of their professional development in the form of portfolio products. They then will seek feedback of the teachers on their work and ask for comments on the added value of assignments for the objectives of a course and in the framework of the competency profile of the Bachelor program as a whole. It is expected that this behavior will influence the teaching style of the academic staff and will help teachers who are reluctant to invest in the new educational concept to move in the desired direction. The extent to which this effect occurs, will answer the second research question.

### **The first experiences**

#### **Preparing for the academic year 1999-2000**

The principles of the new approach have been presented to the teaching staff on several occasions, at first to estimate whether the concept was appealing to them. The overall impression was sufficiently positive to start the preparation of the introduction of the new approach in the program. A few months before the academic year 1999-2000, a group of student-friendly staff members was invited as mentors. Together with the faculty management they developed procedures and a related manual to start the new mentor groups. Involving the mentors at this stage

resulted in their ownership of the concept for the new mentor groups and the way of working in those groups. Elements of the approach are that competency development was related to three major roles of professionals in our field: designer, researcher, and consultant; and that explicit attention should be paid to generic competencies such as planning, self management, interpersonal skills, communication, and academic reflection. In respect to the individual development of the students, a list of products that should be collected in the portfolios was specified. They concern results from assignments in courses that may be considered as evidence of acquired knowledge and skills, thus contributing to the competency profile of the student. Monthly professional meetings of the mentor groups were planned to discuss progress. During these meetings also attention was paid to the quality of the program as experienced by the students. It was expected that the students in their role as beginning educational designer should be interested in strengths and weaknesses of the courses in which they participate. The input from the mentor groups was also considered as valuable for the formal evaluation of running courses. The teaching staff was informed about the intended approach and invited to work accordingly.

Outside the mentor groups, information and communication specialists developed their curricula in close cooperation with teachers from selected courses to arrive at the integration of relevant tasks and assignments in the different courses.

### **Results from the academic year 1999-2000**

The mentor groups appeared to be handicapped by the fact that it was the first year and thus only first-year students were members. The monthly meetings failed also because the students had such a close contact with each other throughout the week, that no substance to discuss remained for the meetings. Course evaluations became a formal ritual with no real impact.

Teachers and students appeared to behave more traditional than expected, leading to much interaction in an instructional context and little in a professional context. The instructivistic teaching style in many courses appeared a dominant factor in shaping student behavior. In stead of working on a professional attitude that complies with the model of the students as young colleagues, the students felt that they went to school to take lessons and make tests.

Moreover, due to technical problems portfolio software was introduced to the students at a late stage (the end of the first semester). Students had then to go back to already completed courses to find the required products for their portfolios. It was unlucky that for unclear reasons they appeared not to be informed about the list of required products that existed from the beginning of the academic year. And when they learned about the list, several students became annoyed because they consider that list as contradictory to the concept. If the portfolios are tools for governing one's own learning process, they should be able to decide by themselves what to put into it. At that time, so much was unclear, that most students failed to work with the portfolios in a proper way. In conclusion, the electronic portfolios were hardly used.

The only thing that really worked was the integration of information and communication skills into courses. The carefully developed set of tasks on information and communication skills made the students acquire the related skills every time they needed them for the assignments in the courses. A literature assignment in a course on pedagogy was used to teach them how to find literature, an assignment to write a paper for an other course was used to explicitly pay attention to writing skills, and so on.

### **2000-2001: Some changes**

The insight was developed that students should not be forced to put products in a portfolio, because this is contradictory to self management. The students, who were interested in the desired approach, told that to us more than once and they were right at this point. The mentors were asked to guide the students in developing self-management skills, using the electronic portfolio as a discussion platform.

Now that students of two study years were member of the mentor groups, activities were specified that could bring the concept to life. The elderly students could now introduce the new students to all kinds of procedures and habits in the faculty. And group discussion could now aim at points of interest for which the vision of both the first year and the second-year students was relevant. The number of official meetings, however, was reduced to seven. This measure was taken to avoid the problem of too few subjects for discussion that came with the monthly meetings in the first year.

Changing the teaching style of teachers towards competence development seemed not to be possible directly. So a major role for the mentor was envisioned given the character of the guild model in the mentor groups. The mentors were asked to work with the students on helping them to use their portfolios for self-governance.

## **Results from the academic year 2000-2001**

This time the mentors started to resist to the idea that they should work with the students in such a way that the students would develop the met cognitive skills to monitor their own professional growth with the electronic portfolios as the basic tool. They argued that the curriculum and the way in which the courses are taught, should have this effect.

Again, the portfolios were hardly used although the software was now available almost from the beginning. But the early start had also a disadvantage. The students were introduced to the portfolio software in a workshop where technical skills were practiced without real products to put into the portfolio. The first products that would be suitable had still to be produced in the courses that just were started. By the time that the portfolios could be used, most students had forgotten how to do that. As there was this time no list of required products, only few students appeared to motivate to start filling their portfolios. Many other students, however, appeared not to be able to decide what they could put into the portfolio. Partly the reason is that they appeared to be very critical of their first-year products, considering their own work as real beginner's work that is not worth to be put into a portfolio.

The cooperation between students from different years appeared to be one-sided. Only in the beginning of the academic year were the older students active when introducing the new students. Subjects of mutual interest to old and new students were not identified. The new students could also not bring anything of relevance for the older student. The question: "What are my benefits?" was hard to answer for the older students.

Still, the students were positive about the meetings of the mentor groups. During the meetings the students discussed general information with their mentor and with each other and they used the meetings as a platform to complain about organizational or educational problems in the faculty. They could speak freely about anything, which gave the meetings an "I am not alone with this" function.

### **Putting students in control**

#### **2001-2002: A last chance for portfolios?**

Gradually it becomes clear that the basic philosophy of the concept "Initiation in the Academic Profession" does not really settle in the faculty. They believe that the concept is worthwhile, is reason for a third attempt. This is where the approach was developed that is the reason for this paper. Again the idea is that the students should develop initiative in using their portfolios as a tool for collecting evidence of their professional growth. In the first week of the academic year, they were trained to use their portfolios in two ways: technically to learn how to put elements in the portfolio and how to manage the portfolio; and conceptually on how to use the portfolio for monitoring and managing professional progress. An adapted guide for the mentor groups explained the purpose and the philosophy: It was recognized that not all students are ready for this kind of metacognitive activity. They are therefore allowed to use or not use their portfolios for self management. Filling the archive with products of courses, however, is this time required to maintain basic portfolio skills until the moment that the student is ready and willing for the intended use.

### **The results so far**

The number of students that works with the portfolios in the intended way is neglectible. There are just a few students who work with their portfolios. These students are mostly using the archive function just for their own purposes and not to reflect on what they have done in past periods. Also most mentors still don't use the portfolios for the individual meetings with the student. Some of them do, but they leave no room for self-directedness by the students because they *require* the students to fill the archive.

In the meantime, the discussion about the usefulness of portfolios has become an issue in a broader perspective. Students who are following the old curriculum (from before the introduction of the new educational concept) start asking for their own portfolios for making overviews of products that they collect in courses during their study. So these oldest students see the purpose and the advantages of portfolios from a need for systematically archiving products. Regrettably, however, when providing them with the portfolio software, they don't find the time to really do it. It seems a similar phenomenon as with the staff members who like the idea of the new educational concept, but do not really change their methods to comply with it.

When student and staff members are asked what they think about the portfolio idea, they are almost all very positive. But still, it did not work out. The project fails and we have to find out what we may learn from it.

## **Discussion**

### **Why portfolios can be a success**

When looking for a field where portfolios do work, the field of Human Resource Development (HRD) is an obvious one. Self-responsible adults, who have a job and related responsibilities, benefit from individual learning arrangements that are reported by collecting evidence of achievements in a portfolio. The use of (electronic) portfolios is in that context appropriate because the learner has sufficient metacognitive (and computer) skills to use the portfolio tool properly. An educating agency (training department, external course provider, etc.) shares the philosophy of competency-based education and is therefore open to assessment on the basis of individual portfolios. This context is essentially different from the university situation where young students who enter the university directly from secondary school, do not have the maturity, the experience and the interest to work along these lines. This is the starting point for discussing why portfolios may fail.

### **Why portfolios fail**

Portfolios fail when the students don't see the value. Portfolio proponents tend to deny the psychological developmental stage of the students. But many (young) students are not prepared or willing to look at themselves in the metacognitive way that is required for proper dealing with portfolios. Further it seems that the spontaneous fun in studying theory is hampered by precise questions about the requirements that have to be fulfilled for a competency-based curriculum. A student who is really involved in a subject, has to make a severe mental switch when he or she has to step outside that subject to analyze on a metacognitive level whether what he or she is doing is a contribution to the development of competence.

And even when students see some value, for instance for building a comprehensive archive of their work during their study, they may misinterpret the function of the archive by denying products of which they are not very proud, like the first-year products when they feel themselves still beginners. To reflect on professional growth, however, these products are needed for reasons of comparison with later accomplishments. Proper guidance of the students by mentors could help, but this requires that the mentors are convinced of the value of portfolios as a tool for monitoring progress. In our case, we were clearly not able to motivate the mentors in this sense.

And there is also a very practical reason why portfolios may fail. That is when the software causes problems. The system may need too many steps for simple tasks; the server may too often be too busy, and so on. In our case, several technical limitations did for certain not stimulate the use of the portfolios.

Portfolios also fail when the teachers fail to adjust their teaching accordingly. Teachers are mainly prepared to carry out a well-defined course. When they have to step beyond the concrete patterns to adjust themselves to individual trajectories, many teachers fail to comply with that fact. The idea that a concept such as "initiation in the academic profession" can be put into practice outside the courses by regarding the traditional courses as occasions for gathering portfolio products that are used by the students and mentors, does not work. The concept and the use of the portfolios have to be operationalized within the courses.

### **Where to go from here?**

Who wants to succeed in an effective learning process, ought to be able to coordinate his own learning process (McCombs, 1988). In order to make the concept "initiation in the academic profession" successful, we will have to arrange a situation in which the students will be helped to get ready to do so. And this has primarily to happen in courses, while the new mentor groups may have a support function. The developmental readiness of the students has to be taken into account. Alexander (1995), for example, mentions three stages for the evolution for the learner. In the habituated stage, the student has a diminutive knowledge level. Having just a little domain-specific knowledge the student appeals on common strategies. The second stage is the ability or competency level. The students get more comprehensive and coherent knowledge of the subject and there is a change the student will select the correct strategy for the specific situation. The third stage is the expert level. At this stage the students have ample knowledge of domain specifics, are ready to regulated themselves, and are able to add new knowledge to the domain. These stages ask for a curriculum line in which each stage has a logical place. This leads in our case to a choice for courses in which the three stages have a natural place: the series of courses about design methodology that runs from the first to the third year. This choice is inspired by the Design Studio as it works at the Master's level at the University of Georgia at Athens (Rieber, 2001). The principle as it will be tried in our program is that third-year students will take responsibility for design assignments while second-year students will act as helpers for specific tasks that need already proper workmanship (like carrying out a literature study or an evaluation), and first

year students will be used for very concrete tasks for which it is not necessary to be very knowledgeable about the specific domain. In this stream, the principles of the concept “initiation in the academic profession” may be fully exploited, together with the use of portfolios. Next to and in balance with this stream, theory courses may still be taught in more traditional ways as long as all teaching complies with the seven principles for good practice in undergraduate education as listed by Chickering en Gamson (1987, quoted by Chickering en Ehermann, <http://www.aahe.org/technology/ehrmann.htm>): (a) good practice encourages contacts between students and faculty, (b) good practice develops reciprocity and cooperation among students, (c) good practice uses active learning techniques, (d) good practice gives prompt feedback, (e) good practice emphasizes time on task, (f) good practice communicates high expectations, and (g) good practice respects diverse talents and ways of learning.

After the lessons learned with our attempts to introduce electronic portfolios faculty wide, we hope that the more modest approach for introducing portfolios and competency-based learning in the design stream of our program, will appear to be the right step to help to initiate our students into the academic profession.

## References

Alexander, P.A. (1995). Superimposing a situation-specific and domain-specific perspective on an account of self-regulated learning. *Educational Psychologist*, 30 (4), 198-193.

Haney, J.J., Czerniak, C.M., & Lumpe, A.T. (1996). Teacher beliefs and intentions regarding the implementation of science education reform strands. *Journal of Research in Science Teaching*, 33, 971 - 993.

Keen, K. (1992). Competence: What is it and how can it be developed? In J. Lowyck, P. de Potter, & J. Elen (Eds.), *Instructional Design: Implementation issues* (pp. 111-122). Brussels, Belgium: IBM International Education Center.

McCombs, B.L. (1988). Motivational skills training. In C.E. Weinstein, E.T. Goetz, P.A. Alexander (Eds.), *Learning and study strategies*, (pp.141-169). San Diego (CA): Academic press Inc.

Rieber, L., King, J. (2001, Nov.). The studio experience at the University of Georgia: Why we did it and how it works. Paper presented at the AECT International Conference, November 7-10, 2001, Atlanta (GA).

Saywer, M.H. (1994). Professional development and educational reform: a study of changes in teachers and classrooms during literature portfolio implementation. Unpublished doctoral thesis. Albany, NY: State University of New York.

Simon, M., Forgette-Giroux, R. (2000). Impact of a Content Selection Framework on Portfolio Assessment at the Classroom Level. *Assessment in Education: Principles, Policy & Practice*, 7 (1), 83-102.

Verhagen, P.W. (2000, Feb.). Over het opleiden van onderwijskundig ontwerpers [About the education of educational designers]. Address on the occasion of accepting the position of professor related to the function of Director of Education at the Faculty of Educational Science and Technology, February, 10, 2000. Enschede: University of Twente.

# The Development of a Model for Using E-Portfolios in Instructional Technology Programs

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## ABSTRACT

*E-portfolios have an ease of use that former paper-based portfolios do not. Virginia Polytechnic Institute and State University uses e-portfolios as a method to assess students in the Instructional Technology graduate program. A core of volunteer graduate students assumed the responsibility of designing a model for using e-portfolios based on the new AECT standards. This paper explores the process and decisions involved in developing a specification for an easy-to-use e-portfolio system to assess, evaluate and display graduate students' work. Issues discussed include the nature of the students' role in the development of the model and their subsequent recommendations for preserving a well-defined structure for the e-portfolio to meet the needs of the faculty without sacrificing the ability of the students to be creative with the display of the content. Implemented items from this investigation included a template-based system with a checklist of required components for the e-portfolio. Included in the recommendations is a data-driven approach that separates the content from the structure of the e-portfolio, making it possible to easily enter the information and re-purpose it for a variety of formats and uses.*

## Background

The professional development portfolio was conceptualized for use by the Instructional Technology (IT) Program at Virginia Tech in 1993 as a means for faculty in the department to assess student work at different stages of matriculation. The portfolio was also a way for the program to gauge its current practices of teaching and learning. For students, the portfolio served as an excellent tool to archive and showcase their work. The early portfolios were displayed in non-electronic form. Students would present the work they completed in class during program-wide examinations (qualifying exam, preliminary exam, final defense). As technologies advanced, the requirement was modified to give students the option of creating an electronic portfolio. This was again modified later to make an electronic portfolio mandatory. The faculty also adopted the original AECT standards that consisted of seven primary competency areas. Although all of the portfolios had the same seven topical headings, the design for these portfolios was left to the discretion of each individual student.

When the new AECT standards came out in 2000, the faculty adopted them for use with the electronic portfolios. The electronic portfolio, however, continued to have several shortcomings. The lack of guidelines led to a great deal of variation in interpreting the AECT standards and in formatting the portfolios. In addition, students had many questions about how to develop their portfolios and faculty members had a difficult time comparing the portfolios across students. As a result, the Professional Development Portfolio (PDP) committee was formed to attempt to incorporate the new AECT standards into the departmental PDP and to find solutions for these problems.

## Beginning of PDP Committee

The Professional Seminar committee, which plans seminars for IT graduate students, developed a seminar on the professional development portfolio anticipating the changes in the AECT standards. During this seminar, the new AECT standards were presented and a number of students who had already created electronic portfolios volunteered to show their work to new students in the program who were going to develop portfolios in the near future. Based on the comments from both students and faculty during this seminar, it became obvious that the portfolios were very different from student to student, which made it difficult for faculty to compare the PDPs. As a result, a student-led committee, which included a faculty advisor, was created to propose a more systematic PDP model for use by future students. Although it still had to be approved by the faculty, this “bottom-up” approach allowed students to have a voice in making changes to enhance the program.

The PDP Committee subsequently went to work on researching electronic portfolios. Researching the use of portfolios, both electronic and non-electronic, was undertaken through three methods: reviewing literature, evaluating other IT programs, and interviewing IT faculty and students.

## Literature Review

In reviewing the literature, the committee investigated portfolios and their definitions, their uses and advantages, and their development. The committee also followed this initial review with an investigation of the AECT standards and their suitability as the assessment measure for the professional development portfolio.

Much of the literature found on the topic of portfolios was in support of their use in education. Portfolios are defined as selective and purposeful collections of student work made available in either electronic or non-electronic formats (Adams & Hamm, 1992). Portfolios provide meaningful documentation of an individual's abilities and represent a "learning history" over a period of time (Meisels, 1994). The use of portfolios in education leads to learning environments that are more student-centered because students accept more responsibility and become the agents of their own education (Paris, 1992)

Barrett (2000) explores the steps necessary for creating portfolios. These steps include deciding on an area of assessment, selecting assessment measures, collecting and selecting content, reflecting on and organizing the content, and presenting the content. The committee decided to adopt this process as a method to guide the subsequent development of the PDP model.

In the investigation of the suitability of using the AECT standards as the assessment measure for the portfolios, a primary question arose: why did the department of Instructional Technology at Virginia Tech choose to use the competencies and what have they to gain from including them in the professional development portfolio? The faculty at Virginia Tech chose to use the AECT competencies because of the reputation AECT has in the instructional technology field and its leadership in promoting professionalism in the field through the National Council for Accreditation of Teacher Education (NCATE). In addition, the IT faculty at Virginia Tech felt that they gained a measure of professional accountability through the use of established standards.

Further investigation of the AECT Standards addressed several areas. These areas included a developmental history of the AECT standards, the theory behind the standards, and the standards themselves. AECT standards came into existence in the 1970s when then president Robert Heinich appointed task forces to look into accreditation and certification issues addressing "concerns for the place of instructional technology in teacher education and for the professional preparation of media personnel" (Association of Educational Communications and Technology, 2000). As the years passed, standards, or guidelines as they were then called, were approved and revised. Finally in 1996, NCATE requested a change to performance-based accreditation, thus requiring AECT to make revisions to the standards once again. AECT revised their 1994 standards to reflect NCATE's request. In order to do so, AECT used the major domains of the field as defined by *Instructional Technology: The Definitions and Domains of the Field*, written by Seels and Richey in 1994 (see Figure 1). The new standards, which were used for this project, were approved by both AECT and NCATE in 2000 (Association of Educational Communications and Technology, 2000).

The AECT standards were based primarily on the theoretical framework contained in the work found in two books: *Instructional Technology: The Definition and Domains of the Field* (Seels & Richey, 1994) and *The Knowledge Base of Instructional Technology: A Critical Examination* (Richey, Caffarella, Ely, Molenda, Seels, & Simmonson, 1993). The first book offers a definition of the field, or assessment area for the portfolio, and a description of the domains and sub-domains of the field. The second book provides the theoretical underpinnings of each domain. Seels & Richey's definition of "instructional technology" is as follows:

Instructional Technology is the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning... The words Instructional Technology in the definition and a discipline devoted to techniques or ways to make learning more efficient based on theory but theory in its broadest sense, not just scientific theory... Theory consists of concepts, constructs, principles, and propositions that serve as the body of knowledge. Practice is the application of that knowledge to solve problems. Practice can also contribute to the knowledge base through information gained from experience... Of design, development, utilization, management, and evaluation refer to both areas of the knowledge base and to functions performed by professionals in the field... Processes are a series of operations or activities directed towards a particular result... Resources are sources of support for learning, including support systems and instructional materials and environments... The purpose of instructional technology is to affect and effect learning (Seels & Richey, 1994, pp. 1-9).

Figure 1 illustrates how the field's theoretical underpinnings are divided into five domains (Seels & Richey, 1994). The related sub-domains are listed under each domain.



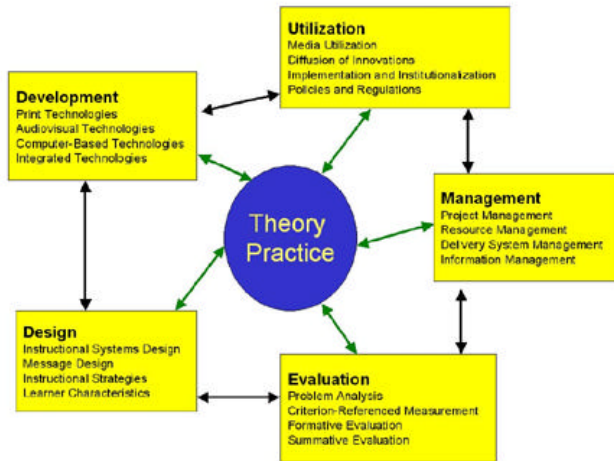


Figure 1. Domains of the Instructional Technology field. (Seels & Richey, 1994)

In terms of the standards themselves, there are two categories: the initial programs in Educational Communications and Instructional Technology (ECIT) and the advanced programs in Educational Communications and Instructional Technology. The initial ECIT programs are the basic entry into the field and are typically masters level programs that lead to certification. The advanced ECIT programs focus on knowledge and skills that go beyond the initial program. There are five domains in each program: development, utilization, design, management, and evaluation. The definitions of the domains are as follows:

Design refers to the process of specifying conditions for learning. Development refers to the process of translating the design specifications into physical form... Utilization refers to the use of

processes and resources for learning... Management refers to processes for controlling instructional technology... Evaluation is the process for determining the adequacy of instruction. (Seels & Richey, 1994, pp. 24-43).

The standards are the same for both programs; it is in the implementation or performance of the standards that the programs differ. The difference between the two is of quantity and depth. The advanced program requires more activities and higher quality performance than the initial program.

Once the literature review was complete, The PDP committee was convinced of the usefulness of portfolios in education. In addition, the committee agreed that the AECT standards justified their use with a well-defined area of assessment (the instructional technology field), a solid theoretical base and a stringent review and accreditation process. The committee recommended the use of the initial ECIT standards as the framework for the master's level Instructional Technology students' portfolios and the advanced ECIT standards as the framework for the doctoral students' portfolios at Virginia Tech.

### Other IT Programs

In order to complement the literature review, the committee attempted to evaluate the use of electronic portfolios by reviewing websites of eight well known IT programs. However, the use of portfolios was not well documented on the web, so the committee contacted representatives of each program directly. Members of the committee e-mailed a contact person from each of the IT programs requesting information about their use of portfolios. The results from evaluating other programs did not provide any consistent approach. Other programs indicated that they: 1.) did not use portfolios; 2.) had an optional portfolio; 3.) had an analog/electronic portfolio option; 4.) created their own standards; and 5.) used AECT or other organizational standards. These findings only served to substantiate the committee's purpose and commitment to developing a more consistent set of PDP standards.

### Faculty/Student Interviews

Interviewing several members of the IT program's faculty provided valuable insight as to the rationale behind the use of portfolios and their needs in regards to the portfolios. Interviews with students in the program also provide information about their needs as well. Although the interviews were done in an informal manner, the anecdotal information the faculty and students provided helped the committee to develop guidelines for use with the portfolios. Much of the information gathered from those interviews was used in the writing of this document and in the subsequent implementations and recommendations that came from this investigation.

### Needs Analysis

Once a framework was adopted for the electronic professional development portfolio model, the committee began to investigate the specific needs of the primary stakeholders, the faculty and the students. The primary goal of

the team working on the model was to identify these needs and to propose a portfolio solution that would accommodate each set of needs as effectively as possible.

Many of the faculty noted the growth they witnessed from the time they first saw a student's portfolio at the qualifying stage to the final defense. Students also recognized their own growth throughout the process and felt as if they had a way to show their work. Moreover, students discussed how employers often appreciated their level of preparedness. Nevertheless, although both the faculty and students had good things to say about the use of portfolios in the IT program, it soon became obvious that the portfolios, as they existed, did not completely meet their needs.

### **Faculty Needs**

The faculty analysis resulted in three specific areas in which needs were expressed with regard to the PDP. These areas include: 1.) Assessment, 2) Accessibility, and 3.) Ease of Use.

### **Assessment**

For the faculty, the primary area of importance in terms of the PDP is the ability to assess the work that students placed in the portfolio. Faculty members decided that a portfolio based on the AECT standards would be a useful method for assessing the overall achievements of students in the program both on their own merits and in comparison to other students. The faculty put forth general requirements for items to include in the portfolio for assessment, consisting of courses taken, activities performed, and products produced. However, as the PDP currently exists, the faculty has not provided specific requirements as to the manner in which the material is to be presented. This was done, in part, to provide the students with freedom to be creative with the design of their PDPs. In many respects, the PDP became, from the student's perspective, the culminating design project of the degree program. The lack of a defined structure, however, has made it difficult for the faculty to be able look at the portfolios and assess the quantity and quality of work from one student to another.

The ability to easily assess the quality of a student's work in comparison to other students using the PDP necessitates that the portfolios be as consistent as possible. This consistency can be achieved through both content and format guidelines. Presently, however, such guidelines have not been created due to the differing nature of student and faculty needs with regard to the PDP. To establish stringent guidelines with regard to content and format may hinder student creativity and also their ability to customize the PDP for specific job searches. Taking some of the control of the development of the PDP away from the students may force them to double their work by creating two portfolios – one for the instructional technology faculty and one for prospective employers.

### **Accessibility**

The faculty also indicated that the portfolios provided by the students needed to be easily accessible. When the portfolios were integrated into the instructional technology department, they were primarily paper-based. Eventually, they were moved to their current electronic form in order to make them easily accessible to the faculty. However, current lack of specific electronic guidelines with regard to how the PDPs are packaged does not ensure easy access from one computer to another or one application to another, such as a browser.

### **Ease of Use**

Finally, the faculty indicated that it would be desirable if the material in the student PDPs could be easily used for data purposes. An example included the ability to track classes, experiences and projects through a database. In such an environment, these variables can be related and compared across students over periods of time.

### **Student Needs**

The student analysis resulted in four specific areas in which needs were expressed with regard to the PDP. These areas include: 1.) Clear definition of requirements, 2.) Flexibility for creativity, 3.) Usability for both academic and job related activities and 4.) Easy modification of content.

### **Defined requirements**

Students used the PDP primarily as a means to fulfill the requirement set out in the series of oral departmental exams. The main requirement set forth by the faculty was that the PDP be web-based and that all classes, projects and professional experiences be represented. The required structure of the document was only that these items be represented so that it was apparent how each related to the original seven competencies detailed by AECT. This limited set of requirements allowed for a great deal of variety in the design of PDPs and promoted confusion among the students as to what was required. Students' inaccurate understanding of the PDP made it clear that it would be helpful to make the requirements more comprehensive. In addition, well-defined structural requirements would reduce the amount of time spent by the students in development of their own PDP. This is especially the case for students who are not as experienced in web or graphic design.

### **Flexibility to be creative**

The original setup allowed for a great deal of personal freedom in structure and displays. Although the PDPs had a similar outline-based structure that consisted of an introduction with a definition of the PDP followed by seven sets of lists, the overall design was unique from student to student. Flexibility was exercised in visual aspects of the site such as images and color scheme. The students wanted guidelines, but also desired the flexibility to design the "look and feel" of their portfolios.

### **Usability for both academic and job related activities**

It was important for students to have a PDP that would also work as a non-academic portfolio. Often the structure used to meet the needs of the IT faculty at Virginia Tech was not appropriate for prospective employers. As a result, students often had to re-design their portfolios for use in job searches. Since the content and format were tied together in the electronic portfolios, this required much time and effort.

#### **Easily modifiable**

The PDP is continuously modified throughout its development. A well-designed PDP should allow for easy addition of content, as well as resorting of items already included, without the need to recreate the document format or navigation systems.

### **Solutions**

The recommendations of the group came in three forms. The first piece was a prototype PDP to be used as a model for future PDPs. A "how-to" manual was developed for students to guide them through creating their own PDPs. The last piece consisted of a set of recommendations for future investigation.

### **Prototype**

The prototype was a website developed from content in an already existing PDP. A template-based system was recommended in order to provide clearer guidelines for the students as they develop their PDPs. Though this recommendation removes the students' flexibility in the aesthetic aspects of their PDP, a more standardized model had the benefit of reducing ambiguity in the development of the PDP. The imposition of these content and format guidelines also meets the need of the faculty to easily locate, analyze, and compare the work of students across PDPs. Through the use of the template, the content is more consistent, comparable, and thus, more assessable.

In the prototype, each page on the site contains a side bar navigation system that allows the viewer to link to any of the other major sections within the site. As shown in Figure 2, the site contained 5 major sections: (1) Entry page, (2) Vita, (3) Checklist, (4) Competency listing, and (5) Referenced items.

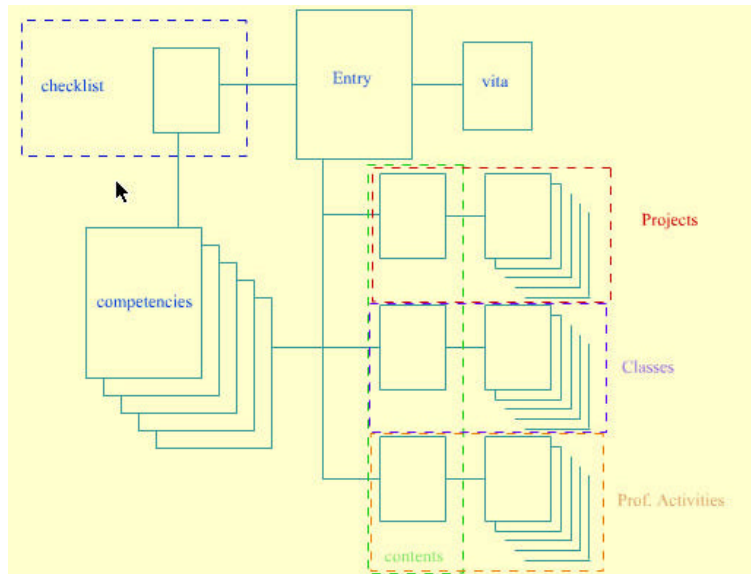


Figure 2. PDP Site Map

The entry page was set up as an introduction to the individual student’s PDP. A personal statement is the most prominent content of the page. The student has the ability to add links to outside personal information from the entry page. (Faculty felt that sensitive personal information should be removed from the entry page, as the PDP site is not secure.)

Faculty and students both felt that a vita should be included as a part of the PDP as it is considered to be a standard element in the professional development of an Instructional Technology student. Since there are already established guidelines for vitas, the prototype simply focused on a location in the site to place the vita, not on how to develop one.

The checklist identifies all of the required components in each of the major areas of the PDP in a table (see Figure 3). The checklist allows the students to identify which components have been included in the PDP by inserting a checkmark graphic into the appropriate cell of the table. This chart is sorted by competency and type of referenced item (classes, professional activities, projects). This method allows the faculty to quickly judge the breadth of the student’s experiences as defined in the portfolio. In addition, it provides the students with a clear set of guidelines indicating what is required in the portfolio.

Figure 3. PDP Checklist

Classes	Professional Activities	Projects	Competency Area
			<b>Design</b>
✓	✓	✓	• Instructional Systems Design
✓	✓	✓	• Message Design
✓	✓	✓	• Instructional Strategies
✓	✓	✓	• Learner Characteristics

The competency section of the site details each of the 5 categories of the AECT standards. Like the checklist, this section is included to assist the students in defining their experiences as they relate to the profession. General as well as itemized definitions as put forth by AECT for each competency are listed on the pages. At the end of each page, there are links to classes, projects, and professional activities that relate to that competency.

In addition to linking to the referenced items through the competency pages, the PDP contains three pages that list out all items by category. The categories for the referenced items are classes, projects, and professional activities. This will allow the viewer to isolate types of work (e.g., class projects, and professional activities) across the competencies. This also allows for alternate groupings and classifications to be set up if needed. Creating a new table of contents, and linking the appropriate items to the contents page, will allow for a completely new structure for a portfolio for viewers other than the IT faculty. If the student wishes to modify the appearance of the page, only the templates for the sections need to be modified and the whole site will reflect the changes.

## “How-to” document

The “how-to” document was created as a guide for students to creating their own PDPs. It contains explanations of competencies, descriptions of the required elements, and recommendations for development and maintenance of the PDP. The competencies describe in detail the AECT areas that the students are expected to use as a framework for populating the content in the PDP. This section also describes how the Instructional Technology department will work with students if they wish to emphasize specific components of these competencies. The description of required elements outlines what the faculty expects from the students in terms of competencies and other activities. These other activities include the development of a vita, consulting, teaching, researching, and mentoring newcomers to the profession. The development and maintenance section includes recommendations for setting up a website to house the PDP and techniques for modifying and updating the content in the PDP. This document provides clear guidelines and developmental procedures for students. In addition, by clearly laying out these guidelines, the faculty has a reference point with which to evaluate the portfolios.

## Future Recommendations

In the discussion of how to develop a PDP, the group made recommendations for future exploration of several concepts. The committee began to explore standard formatting structures for the PDP, such as HTML or XML and the use of cascading style sheets for formatting. These structures could ensure consistency of PDPs across computer platforms and browsers. The committee also investigated the possibility of the PDP structure existing in a database-driven environment that separates the content of the PDP from the recommended template. By having all of the content entered into the database and then automatically populated into the template, the faculty would be able to isolate and/or compare specific pieces of content within a database system. This would facilitate management and organization of large amounts of data from the PDPs from a variety of students across many years. In such a system, students adding content would not need to worry about formatting. The recommended template would automatically be populated with the content maintained in the database. In order to take into account the needs of different students, multiple templates could be offered for the students to use in the data driven system. Pre-designed as well as customizable templates could be chosen as options for PDP display. This would begin to accommodate the individual design needs of the students without forcing them to re-enter their content.

## Summary

In the development of the PDP model, both the process and the outcomes provided positive benefits to the students and the faculty. The students, through the committee, took ownership of the development of the PDP model. In addition, both the students and the faculty had their needs met through the analyses and recommendations developed by the committee. More work is needed in the development of this model, but the committee has developed a solid framework to guide future exploration.

## References

- Adams, L. & Hamm M. (1992). Portfolio assessment and social studies: Collecting, selecting, and reflecting on what is significant. *Social Education*, 56, 103-105.
- Association of Educational Communications and Technology. (2000). *NCATE program standards: Initial and advanced programs for educational communications and technology*. AECT. Available: <http://www.aect.org/Affiliates/National/Standards.pdf> [2000, November 20].
- Barrett, H. C. (2000). Strategic questions: what to consider when planning for electronic portfolios. *Learning and Leading with Technology*, 26(2), 6-13.
- Meisels, S. J. (1994). Performance in context: Assessing children's achievement at the outset of school. In A. Sameroff & M. Haith (Eds.), *Reason and responsibility: The passage through childhood*. Chicago: University of Chicago Press.
- Paris, S. G. (1992). Reflections on learning. In R. Smith and D. Birdyshaw (Eds.), *Perspectives on Assessment*, Volume 1, 209-219.
- Richey, R.C., Caffarella, E.P., Ely, D.P., Molenda, M., Seels, B.B., & Simonson, M.R. (1993, January). The knowledge base of instructional technology: a critical examination. Paper presented at the Annual Convention of the Association for Educational Communications and Technology, New Orleans, LA.

Seels, B. and Richey, R. (1994) Instructional Technology: The Definition and Domains of the Field. Washington, D.C.: Association for Educational Communications and Technology.

# Organizational Alignment Supporting Distance Education in Post-secondary Institutions

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## Abstract

*Leveraging Internet technologies, distance education is enjoying a renaissance of sorts. With its newfound popularity come greater resources as well as higher expectations and greater scrutiny. If distance education programs are to support their dramatic growth and outlive the hype, they must demonstrate performance results. Performance, however, does not just happen. High quality organizations actively support performance through processes, structures, and feedback systems that are aligned with organizational goals. In presenting recommendations for performance-oriented approaches, an established model of organizational alignment is applied to distance education in postsecondary institutions. The model facilitates the analysis of goals, structure, and management practices across the organization, its processes, as well as the work and workers involved. Also presented are performance improvement strategies such as benchmarking and documenting workflows, setting clear expectations, and developing feedback systems. Distance education practitioners can use the organizational alignment model and the strategies discussed to design a new program or transform an existing one.*

## Introduction

### Onto the Web we go

Though distance education has been around in various forms for many years, it is only recently -- with the emergence of web-based delivery platforms -- that it has become the center of so much attention (Foshay & Moller, in press). "Where distance education used to suffer from benign neglect, now everyone wants to have a say in how (it) is used, controlled, and managed" (Sachs, 1999: p.75). Many institutions that previously ignored distance education altogether, are now rushing to deploy their own online programs in an effort to curb damage to their enrollments and possibly their reputations.

### New entries

Post-secondary institutions face leveling student enrollment and rising competition from several directions. Previously viewed as relatively insignificant outreach projects, distance education programs (often from smaller schools) are taking more and more students away from large, regionally dominant schools. Institutions can no longer take for granted the geographic boundaries, or "turfs," that enabled them to virtually monopolize their regions. For-profit educational institutions (e.g., University of Phoenix) are becoming more commonplace and are beginning to gain accreditation. Also, there is an increasing number of professional certification programs, which more and more "free-agent" learners are using in lieu of matriculated programs to gain entry into the workforce and to increase their marketability (Foshay & Moller, in press).

### Veterans transitioning to the Web

Those colleges and universities that long ago embraced distance education (through print, audio, and video technologies) face critical challenges also. Stay within their niche of experience and face possible obsolescence? Or, "take arms against a sea of troubles" and embrace the Internet (with computer mediated communication tools) as the vehicle of choice for distance education? The latter presents significant restructuring and reengineering challenges.

### Current online programs

Though many institutions have decided to take the plunge into web-based distance learning, few have found a winning recipe for success. In fact, in the rush to move courses online, front-end analysis and planning are often first to be discarded for the sake of expedience. It seems that in at least some cases, distance education administrators are taking the 'hare' approach, figuring that just this once, they will win the race against the tortoise.

## Distance education in the spotlight

In a Department of Education survey (1997-98), 20% of the respondents -- 990 post-secondary institutions -- reported that within three years they planned to join the 1,680 schools offering online distance education courses (NCES, 2000). With about 54,000 courses available over the web in 1998, serving 1.6 million students, and with relatively low economic barriers to entry, instead of asking 'Why distance learning?' many university presidents are asking 'Why not?'

With increased attention from university presidents comes more resources and higher status as well as higher expectations and greater scrutiny. Expectations typically take the form of business results: increased enrollments, lower operating costs, and (in some organizations) higher profits. Greater administration commitment and scrutiny ensures that in order to thrive in today's more businesslike post-secondary institutions, distance education programs must demonstrate business results. Otherwise, they risk eventual outsourcing, re-structuring, and (perhaps worst of all) divestiture. A new, results-oriented approach is needed to assure that distance education efforts are focused on goals that are in alignment with the institution's mission.

## Towards business results: A human performance approach

Administrators who recognize the need to instill a results-oriented mindset in their distance education departments may find it helpful to examine proven strategies from the field of human performance technology ("HPT"). HPT draws from a variety of other fields, including management sciences, organizational development, instructional systems design, and quantitative analysis. Figure 1 lists several of HPT's core principles. The strategies that have evolved from these principles are as diverse as HPT's origins. Harmon (1984) provides a hierarchical structure for organizing HPT strategies. These encompass high level, organizational solutions such as total quality management ("TQM") and balanced scorecard evaluation systems as well as more grass roots, individual-oriented applications such as job re-engineering, performance support tools, and 360-degree performance evaluations. In general, HPT advocates measuring actual performance; comparing results against pre-set goals; and implementing systems, processes, and practices that are vertically aligned with those goals. Considering the seeming lack of clear goals, long-term planning, and feedback systems that characterize distance education today, applying an HPT approach may shed some light on best practices for establishing a successful program or transforming an existing program into a results-oriented organization.

*Figure 1. Human Performance Technology core principles*

1. HPT distinguishes between behavior (what someone does) and performance (measurable results achieved), and focuses primarily on performance.
2. Diagnosing performance problems involves measuring the gap between current and expected performance.
3. All performance problems stem from the worker, the environment, or a combination of both.
4. Processes depend on people to make them work, but people are not productive when they are in bad processes.
5. Organizations are open systems with inputs, outputs, processes, and feedback systems. Management, development, and systems functions affect all organizational performance.
  - Management functions guide and control the organization's processes and people through feedback, coaching, reprimands, and incentives.
  - Development functions improve the abilities and capabilities of workers through training, mentoring, and other developmental activities.
  - Systems components are the variables in the work environment that affect performance such as work processes, standard operating procedures, policies, practices, feedback mechanisms, reward structures, etc.
6. Exemplary performance should be used to benchmark workflows, set optimal performance levels, etc.
6. Rather than seeing HPT solutions as expenses, they should be viewed as investments and return on investment ("ROI") calculated for all significant expenditures

*Adapted from Rothwell (1996: pp.30-32)*

## An organizational alignment model

Rummler & Brache's Organizational Alignment Model (1990) provides a useful framework for analyzing and aligning the goal-setting, structure, and management practices of an institution, its distance education processes,



and its staff members. An analysis matrix has been adapted from this model and is shown in Figure 2. The nine cells of this matrix form the nine focal points for analysis. A similar approach involving organizational alignment analysis has been used to analyze parallel issues in training and e-learning contexts (Moller, Benscoter, Rohrer-Murphy, 2000; Prestera & Moller, in press). The model will be applied here in the context of distance education both to the question of what is and what should be present to support the goals, structure, and management of distance education programs. Recommendations, often founded in human performance technology (HPT) and organizational behavior literature, will also be presented.

Figure 2. Organizational Alignment Model

	Goals	Structure	Management
Organization	<i>Cell 1</i> – What will training contribute to the institution’s business goals?	<i>Cell 4</i> – How should we structure the distance education group to meet the institution’s business goals?	<i>Cell 7</i> – How will we measure and improve contributions to business goals?
Process	<i>Cell 2</i> – What are the key success factors for delivering distance education such that they meet the business goals?	<i>Cell 5</i> – How should workflows be structured in order to drive success?	<i>Cell 8</i> – How will we measure and improve the process?
Job/ Performer	<i>Cell 3</i> – What do we need from staff members in order to achieve our process goals?	<i>Cell 6</i> – How should roles and responsibilities be defined in order to meet expectations and deliver process results?	<i>Cell 9</i> – How will we measure and improve individual performance on the job?

Adapted from Rummler & Brache (1990)

## Goals

Rothwell (1996) defines a goal as “a target for achievement... difficult to measure or to achieve in an identifiable time span... developed directly from an organization’s mission or purpose statements.” (p. 115). Goal-oriented by nature, human beings often set goals in pursuit of loftier purposes, reaching out towards visions of a better future. It should be of no surprise then that in the workplace, higher performance is possible when workers know what goals they should achieve and are confident in their ability to achieve them (House, 1971). Therefore, distance education administrators should set departmental goals that are in alignment with the institution’s mission, perceived as achievable, and well-communicated to staff members.

In practice, however, departmental and organizational goals rarely seem to possess these traits. Distance education initiatives are often undertaken with at best only token consideration of institutional, logistical, and instructional needs (Blumenstyk, 1996). When program goals do exist they are often tied closely to misperceptions, which ultimately undermine the success of the initiative. In other instances, goals do not align with the program’s processes and/or they are not communicated properly within the program. In this section, an argument is presented for establishing results-oriented goals, benchmarking successful process goals, and clearly communicating performance expectations for distance education staff.

### Cell 1: Organization goals

Many managers both in the corporate world and in non-profit organizations manage their organizations with only one or two broad performance indicators, which offer limited help in diagnosing performance gaps, are typically too broad for individual workers to feel accountable for them, and generally create a sense of tunnel vision.

### Recommendation 1A: Use balanced approach to goal setting

For decades, managers have sought out the “magic number,” the one indicator that accurately measures the health of their organization. Net income, earnings per share, economic value added, and the other financial measures are widely used in for-profit organizations. Enrollment figures are typically used in academic settings. However, a new paradigm in the area of performance measurement has arisen in the last ten years. It asks the

question, “What are your organization’s key success factors?” and “How can you assess your organization’s performance in those areas?” Kaplan and Norton (1996) categorized these factors into four dimensions of performance: learning, operating efficiency, customer satisfaction, and financial success. Having only one performance measure, the authors assert, is like driving a car with no other indicators but a fuel gauge. In distance education, organizations should move beyond enrollment targets and set goals that -- as a group -- paint as complete a picture of performance as possible. Figure 3 lists some possible success factors that could be part of a distance education balanced scorecard.

*Figure 3. Possible balanced scorecard goals for distance education*

<b>Customer Satisfaction Goals</b>	<ul style="list-style-type: none"> <li>• <u>Improve access</u> - To improve access to instruction for workers whose schedules do not permit enrollment in traditional classroom programs (e.g., night shift crews), are geographically dispersed, or economically challenged.</li> <li>• <u>Individualize instruction</u> – Individualize instruction through blended course offerings (that combine delivery methods) and individualize content selection.</li> <li>• <u>Lifelong learning</u> - To support continuous learning, sustaining learning experiences beyond the time constraints of the classroom.</li> <li>• <u>Employer relations</u> – How can we improve employer perceptions/acceptance of distance education degrees so that students with such degrees are perceived as just as qualified, if not more qualified, than resident students.</li> <li>• <u>Collaboration</u> - To provide collaborative educational opportunities (see discussion groups, CSILEs, and CSCWs).</li> </ul>
<b>Operating Efficiency Goals</b>	<ul style="list-style-type: none"> <li>• <u>Delivery efficiency</u> - To organize, update, and distribute content efficiently and effectively through knowledge management systems (see reusable information objects and reusable learning objects).</li> <li>• <u>Reducing downtime</u> – What steps can be taken to reduce student/faculty downtime caused by technological constraints (e.g., bandwidth) and system errors.</li> <li>• <u>Scheduling flexibility</u> - To improve flexibility in scheduling for faculty and content experts, enabling them to leverage their time.</li> </ul>
<b>Learning Goals</b>	<ul style="list-style-type: none"> <li>• <u>Innovate instruction</u> – Distance education programs can act as testing ground for performance-based assessments, new learning paradigms, and instructional strategies.</li> <li>• <u>Faculty development</u> – As part of the design and delivery process, faculty will develop new medium-specific skills and may improve their overall teaching skills as well.</li> </ul>
<b>Financial Goals</b>	<ul style="list-style-type: none"> <li>• <u>Operating costs</u> - To reduce costs for the student, the school, and the faculty.</li> <li>• <u>Profit</u> – With for-profit organizations, this will inevitably be a measure.</li> </ul>

**Recommendation 1B: Assess needs of distance education stakeholders**

As part of identifying the goals and measures to be included in this scorecard, distance education programs should assess the needs of all stakeholders, including potential and existing students, faculty, administration, and the IT department. For example, though distance education is gaining acceptance among students, it is by no means mainstream. In fact, the non-traditional students who would typically enroll in distance education courses are still the in the minority (Young, 2000). As marketing researchers know firsthand, there is a significant difference between a consumer’s willingness to buy a product or service (acceptance) and their actual motivation to buy it (demand). Assessing the demand for distance education courses (through surveying, pilot studies, etc.) should precede any distance education enterprises. Similarly, student needs regarding content, interface, technical support, scheduling, etc. should be assessed as well. McIsaac (1998) contrasts the U.S. model of distance education with the needs-based approach of non-U.S. institutions.

“Many countries have identified educational needs and have designed distance learning delivery systems to meet those needs. Conversely, it appears that educators and administrators in the U.S. have discovered broadband communication technology and are searching for ways to use the technology to compete for students in the higher education market and to cut costs. (p.24)”

**Recommendation 1C: Communicate goals and measures**

Once the program's goals and measures -- which should be aligned with the institution's mission -- are set, they should be communicated to the entire college or university with support from the President. Support from the top is critical in moving the program past gridlock. This is especially true for distance education programs since their activities must (by their very nature) cross geographic/departmental boundaries and consequently traverse many political obstacles. In describing the success of the distance education program at Northern Virginia Community College's, Sachs (1999) singled out public support from the President as "a key ingredient" and wrote that "This frequently meant discussions were not stuck on 'whether' to do something and moved to 'how to do it. (p. 68)."

## **Cell 2: Process goals**

"Place a good worker in a flawed process and the process wins... every time" (Rummler & Brache, 1990). This truism underscores the importance of establishing a sound operational process for developing and delivering distance education courses. Identifying the goals of a distance learning program requires careful planning and an eye towards the future. Unfortunately, as Simerly (1999) points out, "today's organizational planning must occur in an environment of unpredictability that usually does not proceed in linear ways... (with) key stakeholders often (having) conflicting points of view regarding the planning process and its outcomes" (p.42). With the rise in acceptance of distance education comes greater internal conflict, as more stakeholders are involved, each jockeying for authority over online resources. Also, distance education programs are often in such a hurry to move content online that workflows are rarely documented, measured, or evaluated. Without clear process goals, however, consistency, accountability, and collaboration are jeopardized. If each member of a design team, for example, has a different idea of how the design process is supposed to work -- and there is no documented way of doing things -- time will be wasted and quality may even be compromised. In addition, without documenting workflows, there is no means to retain 'lessons learned' and other valuable organizational learning.

## **Recommendation 2A: Benchmark workflows**

With the rise of Total Quality Management, many organizations are benchmarking their internal and external processes (Rothwell, 1996). Though quantitative sources of data for online distance education are scarce, there are some benchmarking reports, case studies, and guideline recommendations available. Carnevale (2000) describes a benchmarking study of six institutions with strong distance education programs, conducted by the Institute for Higher Education Policy (an executive summary can be downloaded at <http://www.ihep.com/qualityonline.pdf>). Twenty-four benchmarks for online distance education are provided, including the importance of online interaction with instructor and other students. Another source, described by Young (2000), is a faculty report written by 16 professors, which takes a critical look at distance education. The report, for example, recommends against the implementation of complete undergraduate degree programs for traditional students, citing student need of "personal socialization" (this report, titled 'Teaching at a distance' is available online at <http://www.vpaa.uillinois.edu/tid/report/>). Also, several authors provide recommendations and guidelines, often based on practical experiences (Trentin, 1998; Sachs, 1999; McIsaac, 1998; Collis, 1999; Evans, 1999; Prester & Moller, in press).

Benchmarking questions to be answered include:

- What should be happening in course development and delivery that will improve how staff members perform?
- What should be happening to meet or exceed student expectations of their online course experience?
- What resources will staff members need in order to perform optimally?

## **Cell 3: Work/Worker goals**

An examination of what should be happening with work and workers means identifying the competencies needed to achieve the department's process and organizational goals. Competencies are often examined in the context of job descriptions, performance standards, and feedback mechanisms.

## **Recommendation 3A: Write or re-write job descriptions**

Job descriptions document work/worker goals and are an excellent means for communicating expectations. In developing job descriptions, distance education administrators should benchmark the roles, competencies, and performance outputs; compare those against the department's current skill set; identify any gaps that exist; and develop a strategy for acquiring those competencies. This may involve hiring new individuals with the right skills, re-engineering jobs, and/or developing skills through training, mentoring, practice, and other developmental activities. In a survey of 103 distance education experts, Thach and Murphy (1995) identified the principal roles, skills, and outputs required to deliver distance education. Administrators can use these results as a basis for assessing competencies within their departments. The study identifies eleven roles, which are listed along with their descriptions in Figure 4.

Figure 4. Summary of 11 distance learning roles

Role	Description
Instructional Designer	Work with instructors and/or SMEs to design courses, revise existing courses to fit distance learning environment
Instructor	Lead instructional design effort, facilitate course delivery, monitor and evaluate learner performance
Technology Expert	Advise in selection of distance learning technology, ensure reliability of technology, assess future changes in technology
Technician	Keep equipment in running condition, respond to users' questions and problems
Administrator	Manage staff and operations, balance budget, market distance learning programs
Site Facilitator	Assist students in learning at remote sites, distribute/collect materials/assignments, proctor tests
Support Staff	Register students, communicate course schedule/descriptions, coordinate support services
Editor	Edit course content for style, clarity, grammar, and structure. Arrange text layout for presentation
Librarian	Provide library assistance to students, assist with searches, delivery materials to students
Evaluation Specialist	Provide tools and evaluation instruments, monitor program success/problems, consult instructor about evaluation
Graphic Designer	Design attractive, clear layout, ensure materials facilitate learning

Adapted from Thach & Murphy (1995: p. 67-69)

The list includes primary roles (namely, instructors, instructional designers, technology experts, and administrators) as well as supporting roles, such as editors, librarians, and graphic designers. General interpersonal skills, such as communication, collaboration, and teamwork, as well as other more role-specific skills are listed in conjunction with expected performance outputs. These may serve well as benchmarks for writing job descriptions, recruitment profiles, and performance goals. They can also guide the use of development plans and the implementation of certification programs for distance education faculty, instructional designers, etc.

For veteran distance education programs, some additional issues include:

- Do current workers have the technical and interpersonal skills to work effectively with faculty in developing online courses?
- Do supervisors have the necessary skills to deal with the complex political issues of a growing distance education program?

### Recommendation 3B: Link goals to reward system

“People will do what they are rewarded for doing” (Rothwell, 1996: p.257). Though this truism seems relatively obvious, there are still managers around who seem to believe that people perform simply to keep their jobs or out of a sense of loyalty. There are few examples that better demonstrate this than faculty in distance education. Before distance education became an overnight sensation, practitioners were primarily faculty who volunteered. Now, with many faculty being asked to teach online, resistance is on the rise (Dillon & Walsh, 1992). At many universities, and particularly land grant institutions, faculty are evaluated, promoted, and rewarded based primarily on their research, and to a lesser degree, classroom teaching and outreach services. Few schools offer rewards for teaching distance education courses (Wilson, 1998; Wolcott, 1997). In fact, at some universities, distance education faculty earn less credit for teaching than their classroom counterparts (Wolcott, 1997). Expectancy theory tells us

that if faculty value their rewards, and if they feel capable of teaching distance education courses, then performance expectations and rewards will motivate them to teach online (Vroom, 1967). To the extent that distance education is a priority for the institution, administrators should align distance education goals with the university's feedback and reward systems. An example of this may be to give more weight to the development and delivery of distance education courses as a criteria for tenure.

## **Structure**

Performance occurs within the imaginary boundaries of organizational structures, standard operating procedures, and inter-personal relationships. Unlike goals and management practices, structure typically cannot be changed quickly or easily. Formal embodiments of structure, such as titles, operations manuals, and organizational charts can be changed overnight, however, informal structures (norms and values) are ingrained in the organization's culture and are therefore more difficult to transform. Nevertheless, sometimes change they must. With distance education receiving more attention from institutions, governments, and students there is greater pressure to increase enrollment, quality, and speed. In other words, distance education departments may need to focus on performance more than ever before, even as they expand to accommodate a greater number of courses, faculty, and students.

### **Cell 4: Structuring the organization**

The structure of a distance education department relative to the university or college it serves communicates to all members of the institution the relative importance and scope of distance education. Mark (1990) distinguishes four types of structures, a distance learning program, unit, institution, and consortium. With a program, distance education courses are developed entirely by the faculty of an academic department. A distance learning unit is a separate entity operating inside of a college or university. Usually, the unit will have its own full-time staff, which is completely dedicated to developing distance education courses (e.g., Penn State's WorldCampus). A distance learning institution is a wholly separate entity (e.g., British Open University) with its own faculty, administrative, and supporting units. Its sole purpose is the development and delivery of distance education courses. A consortium is an alliance involving two or more institutions or units, which share design and/or delivery resources.

### **Recommendation 4A: Align structure with goals and resources**

The structure selected depends on the institution's goals and its resources. Wilson (1998) writes that "distant courses require three to four times more dollars to develop and three to eight times more faculty (time) and support personnel resources" (p. 3). If true, institutions that seek cost savings from distance education should create sufficient economies of scale to overcome the up-front fixed costs of developing and delivering distance education courses.

Sachs (1999: p.68) recommends the distance learning unit structure over the program, citing several benefits:

- Receives permanent status
- Is allocated a budget
- Has formal representation on committees
- Serves the entire college or university
- Pools distance education resources and knowledge
- Scalability - can expand or contract as needed
- Allows for economies of scale
- Allows for development of complete degree programs

Another benefit of the unit structure is that it enables distance education administrators the flexibility to set goals that cross service area boundaries and impact the entire institution, not just one academic department. Downsides to this structure include increased overhead, possible jealousy from other service areas that compete for budget allocations, and resentment from those departments over their loss of control over distance education resources.

Establishing a separate distance learning institution is one way to avoid some of the political and budgetary obstacles involved with internal units. An institution, acting as a subsidiary, affiliate, or independent of a resident university or college has its very own budget and most of its resources are self-contained. This enables it to be more

agile, flexible, and responsive to changing student needs and organizational goals. Carr (2000) reports that universities, such as Cornell, Temple, and NYU, have established for-profit online subsidiaries for these same reasons.

### **Cell 5: Structuring the processes**

Process structures are commonly operationalized through policies, practices, and standard operating procedures. These structures help a distance education unit maintain consistency in its workflows and outputs, document organizational learning, and accelerate the ramp up time for new hires. One method for developing good processes involves comparing current practices against benchmarked “best practices” collected from successful programs and then identifying any “disconnects” in the workflows. This process of comparison can identify opportunities for improving the efficiency and effectiveness of key distance education processes such as instructional design and class facilitation (Moller, Bencotter, & Rohrer-Murphy, 2000).

### **Recommendation 5A: Empower faculty**

One benchmark of successful distance education processes is faculty involvement (Carnevale, 2000; Young, 2000). Sachs (1999: p.68) points out that by giving faculty a sense of ownership in the course development process, distance education units can:

- Reduce faculty turnover
- Improve design flexibility
- Encourage continuous improvement
- Increase the credibility of their program
- Create a direct pipeline into mainstream activities
- Eventually reach a status of ‘accepted’ in the institutional culture

The challenge for distance education staff is instilling the faculty with a sense of ownership while still maintaining some control over the quality and speed of the process. As Sachs (1999) described, “Some faculty were not adept at taking advantage of the new technology tools at their disposal” (p.70) and therefore require support from instructional design and technology experts to optimize their use of computer-mediated distance learning technologies. In order to achieve this balance of faculty control and expert guidance, processes should be structured in such a way that faculty, designers, and technologists work hand-in-hand as a team to produce a course. Interdependence is critical in combating the silo effect, where functional performance is maximized at the expense of the department’s overall effectiveness (Rummler & Brache, 1990).

Other benchmarks will raise similar issues of process design, such as:

- How will decisions be made regarding the adoption of new technologies?
- How will current courses be revised to work with new technologies?
- What supporting processes will be outsourced?
- How will faculty be selected and certified?
- How will student performance be assessed?
- How are courses going to be selected for online delivery?

### **Cell 6: Structuring the job**

The structure and organizational design of a distance education unit will impact the performance of the department as a whole as well as the effectiveness of individual staff members (Moller, Bencotter, & Rohrer-Murphy, 2000). Rothwell (1996) suggests that redesign efforts may be needed “if the external environment becomes more unstable because it is becoming more competitive or if the internal environment becomes more unstable due to changing work methods or relationships” (p.228). Given the dynamic nature of external environments, distance education administrators would do well to design or redesign their organizations in such a way as to maximize flexibility and responsiveness.

Traditionally, distance education was developed in small teams, typically consisting of an author and an editor. This author-editor model was fast and inexpensive, however, with neither of the participants having instructional design expertise, courses often lacked instructional quality (Moore & Kearsley, 1996). With the advent of more complex technologies (e.g., videoconferencing and computer conferencing) and greater investment into distance education, teams expanded to include producers, instructional designers, technologists, graphic artists, librarians, and other specialists. With increasing project complexity, higher stakes, and more specialists involved,

development time and costs increased exponentially. Development cycles of over one year were not uncommon with this course team model.

### **Recommendation 6A: Structure jobs to optimize quality and efficiency**

There are several other types of design models that organizations can use, including functional, divisional, project, matrix, and virtual design models. Traditional functional and divisional hierarchies may lack the flexibility and responsiveness needed in today's changing distance learning marketplace. The project structure emphasizes the role of project managers who lead temporary projects as the need arises. This may be suitable for fledgling programs that are looking to broaden support for distance education, but it does not lend itself well to long-term projects such as establishing entire online degree programs.

### **Matrix Model**

The matrix design offers some possibilities for organizing distance education efforts. Distance education workers would have two immediate supervisors: the lead for their particular area of expertise (e.g., Instructional Design Lead) and the project managers they work with to develop courses. This model is frequently used by service organizations. In fact, many courseware development firms are organized this way. The design has inherent flexibility, responsiveness, and attention to quality, which can be critical in dynamic, client-oriented environments. On the other hand, this structure can often confuse staff members because of its complexity, its often conflicting priorities, and added layer of management. Another drawback is that by having project managers, whose job it is to plan, coordinate, and control, it may be difficult to instill a sense of ownership in faculty members.

### **Virtual Model**

The virtual design is often seen as the design of the future, with its emphasis on temporary skilled workers, vendors, external consultants, and suppliers. This design of tomorrow is in fact the design of today for the film and television industries. Producers assemble directors, writers, cast members, set designers, as well as other support resources, vendors, and consultants as needed to work together for a limited time. Often, there are some full-time employees but only as many as absolutely necessary. One of the main drawbacks of outsourcing core competencies is the loss of benefits from organizational learning. In distance education, over-use of vendors, external consultants, and temporary help may not sit well with faculty and certainly will do little to build long-term relationships and acceptance within the institutional culture.

### **Consultant Team Model**

Another possible structural design is the consulting team model. In this approach, faculty members lead the development effort and are assisted by instructional design and technology internal consultants. Other support staff members are also involved and may include some vendors, external consultants, and temporary workers. This model can be particularly effective if work processes are geared towards using reusable learning objects, templates, and centralized depositories of reference, content, and assessment materials. These would minimize the amount of customization required for each course and reduce the need for large full-time staffs of specialists. Olcott and Wright (1995) argue against such faculty-centered models, writing that: "distance education has both a responsibility and a unique opportunity to foster a student-centered learning process responsive to the diversity of adult learners" (p.14). Striking a balance between student needs and faculty control can be a difficult proposition for the distance education staff. However, alienating faculty by removing curriculum control and classroom autonomy may, in the final analysis, contribute little to improving the learning experience for the student.

## **Management**

The purpose of management is to put the right people, systems, and resources in place to succeed; assess performance; provide feedback; and take action to maintain alignment with established organization, process, and job performance goals. Key issues to be addressed include:

- Are there feedback systems that help diagnose performance deficiencies?
- Are the right people in place in sufficient numbers and with the right resources to work effectively? In other words, are staff members motivated to perform?
- Are there consequences for negative performance as well as rewards for positive performance results?
- Are expectations, roles, and standards clearly communicated throughout the organization?

### **Cell 7: Managing the organization**

In managing the distance education department, administrators should set milestones, measure performance, and ensure consistent alignment with the institution's mission. Distance education's contribution to the organization should be assessed and weighed against costs and organizational needs. Currently, the proliferation of online distance education courses is precariously perched on several assumptions. Sachs (1999) summarizes them, writing:

“Distance education courses are being developed because there is a perception that there are a large number of students to be gained, often at the expense of other institutions; that it will be cheaper to serve students; or that it will be easier to teach because there will not be class meetings. (P.77).

### **Recommendation 7A: Conduct cost analysis**

Though the debate continues, there is no conclusive evidence to show that online courses are cheaper or easier to implement than traditional classroom instruction. Therefore, cost justifications for distance education should be used cautiously, if at all. Results in business and academic settings indicate that distance learning efforts can reduce costs but too often bring more economic pain than gain (Fornaciari, 1999). A thorough cost analysis may help administrators reduce the economic uncertainty involved and should help them set realistic goals for the distance education programs. Whalen and Wright (1999) offer a framework for cost analysis that can be used to:

- Predict the number of students needed for a program to break even
- Identify the fixed and variable costs involved
- Identify realistic program life spans (time in use before requiring revision)
- Identify the opportunity costs involved
- Compare the development costs for the alternatives available

Rumble (1999) and Jewett (2000) provide similar cost analysis models.

### **Recommendation 7B: Identify the benefits/goals to be achieved**

Distance education potentially offers significant benefits both to the institution and its students. Figure 2 is a partial list of these benefits. Though competition for enrollment and reduced costs are possible macro-benefits, or goals, of distance education, some schools are finding that flexibility is the single, greatest reason to implement it. Schools in Australia, for example, have taken to using the term “flexible learning” to describe the concurrent (dual-mode) usage of distance learning and classroom instruction. As Evans (1999) points out: “The viability of an educational institution is not just a matter of costs. It is also a matter of making judgments about community needs and obligations and state or national priorities” (p.41). Collis (1999) describes the growing movement in Europe towards improving flexibility of location as part of a broader effort to individualize education through flexibility in content selection, learning resources, technology use, and the amount and type of communication. Student-oriented goals such as these can help the university at-large to deal with shifting demographics, changing societal needs (e.g., lifelong learning), and growing competition from non-traditional educational and certifications programs. Also, making flexibility an organizational goal mandates changes throughout the institution and positions the distance education program as an important change agent and resource.

### **Cell 8: Managing the processes**

Design and delivery processes should be benchmarked against established Instructional Systems Design (ISD), Human Performance Technology (HPT), and distance education best practices. For example, the standards developed by the International Board of Standards for Training Performance and Instruction (IBSTPI, 1998) can form the basis for the department's process standards as well as help in the development of hiring, training, and evaluation programs for instructional designers.

### **Recommendation 8A: Assess resource usage**

Managing the process also means allocating the right type and right amount of resources. Distance education resources include technology (hardware, software, infrastructure), skills (ISD skills, technical know-how), funding (for outsourcing, updating systems, etc.), material (e.g., not enough desks), and human resources (not enough people or time to do the job, the wrong skill sets for the job). In order to make educated decisions about resource allocation, managers should put systems into place that assess resource usage.



### **Recommendation 8B: Assess the efficiency of workflows**

In a survey of faculty member attitudes toward distance education, Rockwell, Schaer, Fritz, and Marx (1999) found that 57% of faculty members viewed release time as an incentive and ranked time requirement as their number one obstacle (p.6). With more and more faculty being asked to deliver courses online, the debate is under way: does it take more or less effort and time to develop and deliver a distance education course? A survey of distance education faculty, found that 53% believed that the distance courses required more work than resident classes (NEA, 2000). In a case study comparing a traditional class and an online course, Visser (2000) found that development and delivery time for the online course significantly exceeded those of the traditional course. DiBiase (2000) found contradictory results in a similar comparison case study. However, he did observe that the frequency of contact for online courses is higher (5 times per week) than traditional courses (4 times per week). Considering the narrow margin of difference in the NEA study (44% felt it takes less work) and conflicting results of the case studies, this may be an issue that cannot be resolved in generic terms. Rather, each distance education department should formalize processes for assessing the amount of time needed to develop and deliver courses as well as the relative quality of those courses. In light of those results, a more accurate evaluation can be formed and, when necessary, steps can be taken to reduce the amount of time and effort required of faculty. Though faculty release time is important from the standpoint of faculty morale, it is even more critical from the standpoint of quality. Faculty and the specialists who support them need to have sufficient time for design, development, and delivery. There should also be formative and summative evaluation of courses to help team members adjust their outputs and continuously improve their courses. As Moore (2000) points out: "it's not a question of having less work or more work..., but (rather) getting better quality out of the same effort as a result of that effort being more effectively organized and applied" (p.5).

### **Cell 9: Managing the job/workers**

Managing a distance education staff can be a challenging job. Not long ago, distance education courses were created by small teams of two to three people. Today, given the complexity of technology-based instruction, distance education programs rely on a variety of specialists. How will these specialized workers be managed? Who is best qualified to manage them and evaluate their performance? Given the specialized nature of their work, will staff members need to be evaluated against performance standards for their given fields or should they be held accountable for more general team performance standards such as quality, speed, and costs? How will staff members receive feedback for their individual and/or team performance? Thomas Gilbert (1978) points out that "more than half of the problems of human competence can be traced back to inadequate (feedback) data" (p.179).

### **Recommendation 9A: Performance standards**

Performance standards act as an anvil against which performance is shaped. Without standards, it is difficult, perhaps impossible, to distinguish consistently good performance from bad, skilled workers from poor ones, and best practices from sub-optimal procedures. Performance standards provide an objective basis for performance-oriented feedback mechanisms.

### **Recommendation 9B: Feedback mechanisms**

Rothwell (1995) found that feedback-related strategies make up 3 of the top 4 most frequently encountered human performance improvement interventions. This reflects the paramount importance of information and communication in an organization. Feedback helps with "goal refinement, documentation, determination of impact, and program improvement" (Hawkes, 1996: p.31). Distance education administrators should establish mechanisms for clear and timely communication of roles, responsibilities, performance expectations, performance results, and any information that is pertinent to the work of developing distance education courses. Without such information, performance suffers. On the other hand, "significant performance gains can be achieved by improving the flow of information about the work" (Rothwell, 1996: p.186). Sources of performance feedback include student comments about their experiences, help desk logs, budget-to-actual reports, and peer evaluations.

## **Conclusion**

Distance education in postsecondary institutions is seeing dramatic growth. Is this upsurge an anomaly or is distance education a force that will stand the test of time and succeed in bringing about profound changes in the way we teach and learn? Though we cautiously subscribe to the latter, much will depend on distance education's ability to deliver results, not just in terms of bottom-line returns for institutions but also in terms of:

- Fruitful educational experiences for students
- Perceptions that employers have of students with online degrees
- True access across socio-economical classes and regions
- Adoption of innovative instructional approaches

This paper has examined the organizational alignment of distance education programs. Applying performance improvement strategies, recommendations have been presented for communicating goals, benchmarking processes, measuring results, providing timely feedback at all levels, and rewarding performance. A more complete summary is provided in Figure 5. Without a clear vision of performance goals, without plans for making the vision a reality, and without the structures and systems to manage performance, distance education administrators compromise organizational results and may realize only too late that performance does not just happen.

Figure 5: Summary of recommendations

	<b>Goals</b>	<b>Structure</b>	<b>Management</b>
<b>Organization</b>	<i>Cell 1</i> – Establish balanced scorecard with goals that are aligned with the institution’s mission.	<i>Cell 4</i> – Determine the size and scope of the distance education organization.	<i>Cell 7</i> – Assess student and organizational needs. Evaluate results through cost/benefit analysis.
<b>Process</b>	<i>Cell 2</i> – Benchmark processes by identifying best practices for instructional design, development, and delivery of online courses.	<i>Cell 5</i> – Use benchmarks to set process standards and develop policies and practices to support performance.	<i>Cell 8</i> – Evaluate processes to determine standard resource usage levels. Use feedback to improve efficiency and quality.
<b>Job/ Performer</b>	<i>Cell 3</i> – Identify roles needed, responsibilities, and outputs. Tie performance goals to reward system.	<i>Cell 6</i> – Develop a workflow design that supports best practices.	<i>Cell 9</i> – Set employee performance standards, measure results, and use feedback to improve performance.

## References

- Blumenstyk, G., (1996, January). Faculty group calls for caution and curbs on distance education. Chronicles of Higher Education, A20.
- Carnevale, D. (2000, April). A study produces list of 24 benchmarks for quality distance education. Chronicle of Higher Education 46(31), A45.
- Carr, S. (2000, June). Faculty members are wary of distance education ventures. Chronicle of Higher Education 46(40), A41-A42.
- Collis, B. (1999). Telematics-supported education for traditional universities in Europe. Performance Improvement Quarterly 12(2), 36-65.
- DiBiase, D., (2000). Is distance teaching more work or less work? The American Journal of Distance Education 14(3), 6-20.
- Dillan, C.L. & Walsh, S.M., (1992). Faculty: The neglected resource in distance education. The American Journal of Distance Education, 6(3), 5-21.
- Evans, T., (1999). From dual-mode to flexible delivery: Paradoxical transitions in Australian open and distance education. Performance Improvement Quarterly, 12(2), 84-95.
- Fornaciari, C.J. (1999, December). Distance education as strategy: How can your school compete? Journal of Management Education 23(6), 703-718.
- Foshay, W.R. & Moller, L. (in press). Trends in the external environment as a context for critiquing the field of instructional design and technology. In G. Anglin (Ed.), Critical Issues in Instructional Technology. Englewood, CO: Libraries Unlimited.
- Gilbert, T.F., (1978). Human Performance Engineering: Worthy Performance. New York: McGraw-Hill.
- Harmon, P. (1984). A hierarchy of performance variables. Performance and Instruction, 23(10), 27-28.
- Hawkes, M.L. (1996, October). Evaluating school-based distance education programs: Some thoughts about methods. NASSP Bulletin 80(582), 26-33.

- House, R.J., (1971, September). A path-goal theory of leadership effectiveness. Administrative Science Quarterly, 321-339.
- IBSTPI (1998), Instructional Design Competencies [On-line]. International Board of Standards for Training, Performance, and Instruction. Available: [www.ibstpi.org](http://www.ibstpi.org) (Accessed: 1/15/01).
- Jewett, F.I., (2000). BRIDGE: A model for comparing the costs of using distance instruction and classroom instruction. The American Journal of Distance Education, 14(2), 37-47.
- Kaplan, R.S. & Norton, D.P. (1996). The balanced scorecard : Translating strategy into action. Boston, MA: Harvard Business School Press.
- Mark, M., (1990). The differentiation of institutional structures and effectiveness in distance education programs. In M.G. Moore (Ed.), Contemporary Issues in American Distance Education. London: Pergamon.
- McIsaac, M.S., (1998). Distance learning: The U.S. version. Performance Improvement Quarterly 12(2), 21-35.
- Moller, L., Benscoter, B., & Rohrer-Murphy, L. (2000). Utilizing performance technology to improve evaluative practices of instructional designers. Performance Improvement Quarterly 13(1), 84-95.
- Moller, L., & Draper, D. (1996, Winter). Examining the viability of distance education as an instructional approach. The Journal of Continuing Higher Education, 12-21.
- Moore, M.G. & Kearsley, G. (1996). Distance education: A systems view. Washington, D.C.: Wadsworth Publishing Company.
- Moore, M.G. (2000). Editorial: Is distance teaching more or less work? The American Journal of Distance Education 14(3), 1-5.
- NCES (2000). Distance education at post-secondary education institutions: 1997-98 [On-line]. National Center for Education Statistics of the U.S. Department of Education. Available: <http://nces.ed.gov> (Accessed: 12/10/00).
- NEA (2000). A survey of traditional and distance learning higher education members of the National Education Association. Available: <http://www.nea.org/he/aboutthe/distance.htm> (Accessed: 1/20/01).
- Olcott, D., Jr., & Wright, S.J., (1995). An institutional support framework for increasing faculty participation in postsecondary distance education. The American Journal of Distance Education, 9(3), 5-17.
- Pretera, G.E. & Moller, L., (in press). Exploiting opportunities for knowledge building in asynchronous distance learning environments. Quarterly Review of Distance Education.
- Rockwell, S.K., Schauer, J., Fritz, S.M., & Marx, D.B., (1999, Winter) Incentives and obstacles influencing higher education faculty and administrators to teach via distance. Online Journal of Distance Learning Administration 2(4), Retrieved December 10, 2000: <http://www.westga.edu/~distance/rockwell24.html>.
- Rothwell, W.J. (1996). Beyond training and development: State-of-the-art strategies for enhancing human performance. New York: AMACOM, a division of the American Management Association.
- Rothwell, W.J., (1995). Identifying and solving human performance problems: A survey (unpublished survey results). Pennsylvania State University.
- Rumble, G. (1999). Cost analysis of distance learning. Performance Improvement Quarterly 12(2), 122-137.
- Rummler, G., & Brache, A.P. (1990). Improving performance: How to manage the white space on the institution chart. San Francisco, CA: Jossey-Bass.
- Sachs, S.G. (1999). The mature distance education program. Which way now? Performance Improvement Quarterly 12(2), 66-83.
- Simerly, R.G. (1999, Winter). Providing leadership for technology enhanced education: The challenge of institutional macro change. Journal of Continuing Higher Education 47(1), 40-48.
- Thach, E.C., & Murphy, K.L. (1995). Competencies for distance education professionals. Educational Technology Research and Development 43(1), 57-71.
- Trentin, G., (1998, May-June). Computer conferencing systems as seen by a designer of online courses. Educational Technology, 36-43.
- Visser, J.A., (2000). Faculty work in developing and teaching web-based distance courses: A case study of time and effort. The American Journal of Distance Education 14(3), 21-32.
- Vroom, V. (1967). Work and Motivation. New York: Wiley.
- Whalen T., & Wright, D., (1999). Methodology for cost-benefit analysis of web-based teledistance education: Case study of the Bell Online Institute. The American Journal of Distance Education 13(1), 24-44.
- Wilson, P.N. (1998). To be or not to be? Selected economic questions surrounding distance education: Discussion. American Journal of Agricultural Economics 80(5), 990-993.

Wolcott, L.L., (1997). Tenure, promotion, and distance education: Examining the culture of faculty rewards. The American Journal of Distance Education 11(2), 3-18.

Young, J.R. (2000, January). Faculty report at University of Illinois casts skeptical eye on distance education. Chronicle of Higher Education 46(19), A48.

# Effects of Personalized Instruction on Mathematics Word Problems in Taiwan

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## Abstract

*This study investigated the effects of personalized instruction on the achievement and attitudes of Taiwanese students on two-step mathematics word problems. A total of 136 fourth-graders in a Taiwanese public school participated in the study. Subjects initially completed a Student Survey on which they chose their favorite foods, sports, stores, classmates, and other selections. The most popular items were then used to create personalized math word problems for the pretest, personalized instructional program, and posttest. Subjects were blocked by ability based on their pretest scores and were randomly assigned within ability levels to either a personalized or non-personalized version of the print-based instructional program. After finishing the program, subjects completed a student attitude survey and the posttest. A repeated-measures ANOVA revealed that subjects in the personalized treatment made significantly greater pretest-to-posttest gains than those in the non-personalized treatment. Subjects also performed significantly better on the personalized pretest and posttest problems than on the non-personalized problems. Personalized subjects and higher-ability students both had significantly more positive attitudes toward the instructional program than their non-personalized and lower-ability counterparts.*

## Introduction

Data from the National Assessment of Educational Progress (1992a, 1992b) indicate that mathematics word problems are difficult for students at all age levels in elementary and secondary schools. A major cause of the difficulty appears to be the students' inability to convert the problems into the math operations that must be performed to solve them (Hart, 1996). Some researchers have also noted that lack of familiarity with word problem structures may also contribute to poor student performance (Mayer, 1982; Rosen, 1984).

Personalizing mathematics word problems, such as incorporating personal background information into the problem content, can lead to improvements in performance (Anand & Ross, 1987; Davis-Dorsey, Ross, & Morrison, 1991; Lopez & Sullivan, 1991, 1992). Anand and Ross (1987) tested the effect of using computer-assisted instruction to personalize mathematics instruction for elementary school children. Students who received personalized instruction scored significantly higher on math word problems involving rule recognition and transfer than those whose instruction was not personalized. The authors claimed that personalized contexts increased students' comprehension and motivation by helping them interpret important information in the problem statement. Davis-Dorsey et al. (1991) found that both second-grade and fifth-grade students made significant achievement gains from rewording and personalization of the context in math word problems. In two separate studies with rural eighth-grade Hispanic American students, Lopez and Sullivan (1991, 1992) found significant overall achievement effects for personalization on one-step and two-step mathematics word problems.

Several studies have found that student attitudes are more positive when student interests and preferences are incorporated into instruction in order to personalize it. Ross and his colleagues (Ross, 1983; Ross, McCormick, & Krisak, 1986; Ross, McCormick, Krisak, & Anand, 1985) employed personalization in a series of adaptive instruction studies. Favorable attitude results were obtained when preservice teachers received education-related materials and nursing students received medical-related materials, and poorer results were attained when each group received the other's materials. Herndon (1987) found that high school students who received instruction based on common group interests had significantly more favorable attitudes and higher return-to-task motivation than students whose instruction was not interest-based. Cordova and Lepper (1996) and Hart (1996) also found more favorable attitudes or motivation toward personalized than toward non-personalized instruction.

Researchers have offered two theory-based explanations for the effectiveness of personalized instruction in studies where it has yielded better results than non-personalization. One is that students' greater familiarity with personalized problem situations and content may enable them to solve problems more easily by reducing their cognitive load (Lopez & Sullivan, 1991, 1992; Miller & Kulhavy, 1991). This position is supported by D'Ailly, Simpson, and MacKinnon's (1997) statement that "self-referencing facilitates general encoding processes and decreases the load on working memory during problem solving."

The second explanation is based on interest theory (Mayer, 1998). Mayer notes that students exert more effort and are more successful solving problems that interest them than problems that do not. Several researchers have cited greater student interest and motivation as reasons for better performance under personalized instruction (Cordova & Lepper, 1996; Lopez & Sullivan, 1992; Ross & Anand, 1987). The “reduced cognitive load” and “increased interest” explanations appear to be compatible with one another rather than being alternative or competing explanations.

The present study was designed to address the unanswered questions from the Ku and Sullivan (2000) research and to investigate the stability of the other findings from that study and other research. The likelihood of a ceiling effect, which confounded interpretation of the personalization versus non-personalization issue in the earlier research, was reduced by conducting this study with fourth-grade students instead of fifth graders as in the earlier study. This study was also conducted with 136 students, or nearly twice as many as the earlier one, to increase the power of the statistical analyses. These changes were designed to provide a clearer answer to the question of whether instruction incorporating personalized math word problems would yield significantly better student performance than instruction using only non-personalized items.

The question of whether merely stating test items in personalized form would yield better performance than stating them in non-personalized form, irrespective of the type of instruction students receive, was addressed by including an equal number of personalized and non-personalized items on the pretest, as well as on the posttest. Including personalized and non-personalized items on the pretest, as well as on the posttest, in the present study was designed to permit more direct and stable comparisons of the effects of the two types of test items alone and in combination with the instructional treatments.

The present study investigated the effects of two levels of group personalization (personalized, non-personalized) on the achievement of fourth-grade Taiwanese students on two-step mathematics word problems. Mathematics ability level, as determined by scores on the pretest administered prior to the instructional phase of the study, was also included as a variable because it is an important factor in mathematics achievement and because of differential findings by ability level in earlier research on personalization (Dwyer, 1996; Ku & Sullivan, 2000; Lopez & Sullivan, 1991).

The primary research questions for the study were as follows:

1. Does personalization of instruction increase the achievement of Taiwanese students on mathematics word problems?
2. Does personalization of instruction have a differential effect on the performance of higher-ability and lower-ability students on mathematics word problems?
3. Do Taiwanese students perform better on personalized word problems than on non-personalized problems irrespective of the type of instruction (personalized or non-personalized) they receive?
4. Does personalization of mathematics word problems influence student attitudes toward the instruction on these problems?

## **Method**

### **Subjects**

A total of 136 fourth-grade Taiwanese students from four classes taught by different teachers at a public elementary school in Taiwan participated in this study. The school is located in a mid-level income and socioeconomic area in Fengyuan, a city with a population of approximately 160,000 people.

### **Materials**

Student Survey. A 20-item student survey was used to determine the personal backgrounds and interests of the participants. Topics included the names of the students’ favorite places, activities, sports, friends, convenience stores, foods, and so forth. Students wrote in two favorite responses for each survey item.

The survey was administered one week prior to the pretest. Responses to each survey item were tabulated by the experimenter and then used to design the personalized version of the instructional program and the tests.

Instructional Program. Two parallel versions of an instructional program on two-step math word problems were developed in print form in Chinese. Taiwanese students learn addition and subtraction in the third grade and multiplication and division in the fourth grade. The word problems in the instructional program and the test items were taken directly from the fourth-grade and fifth-grade mathematics

textbooks used by the participants. The program was administered after the students had studied one-step multiplication and division, and it covered two-step processes that they had not yet formally studied.

The non-personalized version of the instructional program was written first and included standard problem types from the students' math textbook. The personalized version was then written by incorporating the most popular referents (places, foods, sports, names, etc.) from the Student Survey into the previously non-personalized version.

An example of a practice item in personalized and non-personalized form is provided below. The example item requires using multiplication followed by division.

- |                   |   |
|-------------------|---|
| Non-personalized: | The teacher has 2 dozen cans of soft drink to be shared equally by 8 students. How many cans of soft drink does each student get?       |
| Personalized:     | The teacher, Ms. Sue, has 2 dozen cans of milk tea to be shared equally by 8 students. How many cans of milk tea does each student get? |

The instructional program covered procedures for solving two-step word problems involving four different combinations of multiplication and division operations (multiply-multiply, multiply-divide, divide-multiply, divide-divide) with whole numbers. A four-step strategy based on the work of Enright and Choate (1993) was incorporated into the instructional program for both treatments. The four steps, which had not been taught to the students previously, were: 1. Read the question. 2. Think through the problem. What must be found out? What steps are involved? 3. Choose the steps and do the math. 4. Check your answer.

Instruction for solving each of the four types of problems contained the four-part Enright and Choate strategy with two worked examples for each problem type. After the examples for each problem type, the instructional program contained two practice problems for the students to work. Each pair of practice problems was placed on a page with enough open space to allow students to work out the problems. When students completed the instructional program, the experimenter collected the programs and scored the practice problems. On the following day, the experimenter conducted a review in which he provided the answers to the practice problems and the explanations for them. All materials used in the study were in Chinese.

## Procedures

The Student Survey was administered to participants two weeks prior to the treatment. The most popular choices (places, foods, sports, and so forth) from the survey were subsequently used to convert the non-personalized problems into the personalized content for the pretest, the instructional program, and the posttest. The pretest was administered one week after students filled out the Student Survey.

After the pretests had been scored, the subjects were blocked within each class by their pretest scores into higher-ability and lower-ability groups, and were assigned within blocks to either the personalized or the non-personalized version of the instructional program. Sixty-eight subjects each, 34 higher-ability and 34 lower-ability, were in the personalized treatment and the non-personalized treatment. The mean pretest score was 9.35 ( $SD = 1.65$ ) for the 68 higher-ability subjects and 3.74 ( $SD = 2.11$ ) for the 68 lower-ability subjects.

The experimental part of the study took place over three 40-minute class periods on three different days one week after the pretest. The experimenter served as the instructor for all treatments in regularly scheduled math classes in four different classrooms. The experimenter read instructions to all students and told them that they would be helping with the development of a new math program in Taiwan and that they should try their best to learn and to solve the problems. On the first day, subjects completed the instructional part of the program. On day two, the experimenter went over the eight practice problems with subjects and wrote the answers on the blackboard. After this review, students filled out the student attitude survey and teachers completed the teacher attitude survey. On the final day, subjects took the posttest.

## Criterion Measures

Pretest. A total of 24 problems were developed, in both personalized and non-personalized forms, for the pretest and posttest. Twelve items, three from each of the four combinations of multiplication and division math operations, were randomly assigned to the pretest and the remaining twelve were assigned to the posttest. Thus, both the pretest and the posttest contained twelve two-step math word problems involving whole numbers. The problems on the pretest were in random order within each problem type and those on the posttest were in the same order by problem type. Each test consisted of three problems involving a multiplication operation followed by a second multiplication operation (multiply-multiply), three problems involving multiplication followed by division

(multiply-divide), three problems involving division followed by multiplication (divide-multiply), and three problems involving division followed by a second division operation (divide-divide).

The pretest was constructed and named as two different forms, Form A and Form B. The total of 24 items were randomly assigned as 12 pretest and 12 posttest items as described above. In Form A, problems one through six were written as non-personalized problems and problems seven through twelve were written as personalized problems. In Form B, the non-personalized problems from Form A (problems one to six on Form A) were converted to the personalized problems seven through twelve, and the personalized problems from Form A (problems seven through twelve on Form A) were converted to non-personalized problems one through six. Thus, the same 12 items appeared in both personalized and non-personalized forms across the two test versions, with the six items in non-personalized form as items 1-6 on each form and the six personalized items as items 7-12 on each form. The answer to each problem was scored as correct only when the correct final answer to the problem was given. The KR-20 reliability coefficient was .83 for the pretest.

Posttest. As with the pretest, posttest problems were developed and administered in two forms. The first six problems on Form A of the posttest were in non-personalized form and the second six problems were in personalized form. The first six problems on Form B of the posttest were items seven to twelve from Form A in non-personalized form and the final six problems on Form B (Items 7-12) were items one to six from Form A in personalized form. Thus, the problems on Form A and Form B of both the pretest and the posttest consisted of six non-personalized items followed by six personalized items. Like the answers on the pretest, each answer on the posttest was scored as correct or incorrect only based on the final answer. The KR-20 reliability coefficient was .87 for the posttest.

Subjects who received Form A on the pretest received Form B on the posttest, and those who received Form B on the pretest received Form A on the posttest. The overall mean proportions correct for all subjects across both tests were .68 for Form A and .69 for Form B.

Student Attitude Survey. A ten-item attitude survey served as the criterion measure for assessing the students' attitudes and motivation. Eight of the ten items were four-choice Likert-type questions that assessed student attitudes and continuing motivation toward the instruction. These items dealt with such matters as how interesting and how easy the instructional programs was, how much students learned from it, whether students could do two-step problems well, and whether they would like to do more problems like those in the program. Responses to these eight items were assigned a score of 4 for the most positive response and a score of 1 for the least positive response. The two remaining items were open-ended questions dealing with student likes and dislikes about the instructional program. The KR-20 reliability coefficient for the eight Likert-type items was .70.

Teacher Attitude Survey. A seven-item teacher survey, consisting of six four-choice Likert-type items and one open-ended question, was used to assess teacher attitudes toward the instructional program and the personalization strategy. Items dealt with topics such as the appropriateness of the program, its quality, whether it helped students learn, the effectiveness of personalization, and whether the teachers liked personalization. Teacher responses to the Likert-type items, like those of the students, were scored from 4 (most positive) to 1 (least positive).

## **Data Analysis**

The data analysis for student achievement was a 2 (Treatment: Personalization and Non-personalization) x 2 (Ability Level: Higher Ability and Lower Ability) x 2 (Test Occasion: Pretest and Posttest) x 2 (Problem Type: Personalized and Non-personalized problems) repeated-measures univariate analysis of variance (ANOVA). Treatment and ability level were between-subjects variables in the analysis and test occasion and problem type were within-subjects variables. Attitude data were analyzed using a 2 (Treatment) x 2 (Ability Level) x 8 (Survey Items) multivariate analysis of variance (MANOVA) for the overall survey means.

## **Results**

The results are reported in this section for achievement, student attitudes, and teacher attitudes.

### **Achievement**

The pretest and posttest data for the two levels of personalization, the two ability levels, the two test occasions, and the two problem types are shown in Table 1. The achievement data for each variable in the four-factor design are discussed below.



**Treatment.** For personalization level, the mean overall scores across the two test occasions were 8.45 (70%) for the personalized subjects and 7.93 (66%) for the non-personalized subjects. ANOVA revealed that the difference in mean scores between the two personalization levels was not statistically significant,  $F(1, 132) = 2.37$ ,  $MSE = 3.80$ ,  $p = .126$ . However, the difference for treatment in this analysis was reduced due to the fact that the pretest and posttest scores were combined for each of the two levels of personalization because of the repeated-measures design. The mean scores by personalization level on the pretest (that is, prior to the treatment) were identical for the two levels: 6.54 items correct (55%) for the personalized treatment and 6.54 (55%) for the non-personalized treatment. In contrast, the mean posttest scores by treatment were 10.35 (86%) for the personalized treatment and 9.32 (78%) for the non-personalized treatment.

The differential pattern of identical scores for personalization level on the pretest, but a higher score for personalization than for non-personalization on the posttest, was reflected in a significant treatment by test occasion interaction,  $F(1, 132) = 8.27$ ,  $MSE = 1.09$ ,  $p < .01$ ,  $\eta^2 = .06$ . A post hoc paired-samples  $t$  test revealed that the posttest score of 10.35 for the personalized treatment was significantly higher than the score of 9.32 for the non-personalized treatment,  $t(67) = 3.01$ ,  $p < .01$ .

Table 1  
Mean Scores by Treatment, Ability Level, Test Occasion, and Problem Type

Test Occasion and Treatment	Problem Type			
	Personalized		Non-personalized	
	Higher ability	Lower ability	Higher ability	Lower ability
<b>Pretest</b>				
<b>Personalized</b>				
M	4.79	1.94	4.71	1.65
SD	(0.98)	(1.28)	(1.09)	(1.28)
<b>Non-personalized</b>				
M	4.85	2.18	4.35	1.71
SD	(0.96)	(1.24)	(0.98)	(1.22)
Sub-totals				
M	4.82	2.06	4.53	1.68
SD	(0.96)	(1.26)	(1.04)	(1.24)
<b>Posttest</b>				
Personalized				
M	5.82	4.59	5.85	4.44
SD	(0.46)	(1.84)	(0.44)	(1.74)
Non-personalized				
M	5.68	3.94	5.35	3.68
SD	(0.59)	(1.69)	(0.95)	(1.80)
Sub-totals				
M	5.75	4.27	5.60	4.06
SD	(0.53)	(1.78)	(0.78)	(1.80)

Overall mean scores by test occasion and variables:

	Treatment Ability		Problem Type	
<b>Pretest</b> Personalized	= 6.54	Higher = 9.35	Personalized	= 3.44
Non-personalized	= 6.54	Lower = 3.74	Non-personalized	= 3.10
<b>Posttest</b> Personalized	= 10.35	Higher = 11.35	Personalized	= 5.01
Non-personalized	= 9.32	Lower = 8.32	Non-personalized	= 4.83

Overall Personalized	= 8.45	Higher = 10.35	Personalized	= 4.23
Non-personalized	= 7.93	Lower = 6.03	Non-personalized	= 3.97

Note. Total possible score equals 12 items correct on each test for treatment, ability level, and test occasion, and six items correct for each problem type.

**Ability Level.** Higher-ability students outscored lower-ability students across the two tests, 10.35 (86%) to 6.03 (50%). This difference for ability level was statistically significant,  $F(1, 132) = 167.49$ ,  $MSE = 3.80$ ,  $p < .001$ ,  $\eta^2 = .56$ .

The 2 x 2 x 2 x 2 ANOVA also yielded a significant ability level by test occasion interaction,  $F(1, 132) = 52.30$ ,  $MSE = 1.09$ ,  $p < .001$ ,  $\eta^2 = .28$ . This interaction reflected the fact that higher-ability students improved less from pretest to posttest than lower-ability students. Higher-ability subjects had mean scores of 9.35 (78%) on the pretest and 11.35 (95%) on the posttest, an improvement of 2.00 items correct, whereas lower-ability subjects had mean scores of 3.74 (31%) on the pretest and 8.32 (69%) on the posttest, an improvement of 4.58 items correct.

**Test Occasion.** The mean scores for test occasion were 6.54 (55%) for the pretest, and 9.84 (82%) for the posttest, a mean pretest-to-posttest increase of 3.30 items correct. This difference was statistically significant,  $F(1, 132) = 338.85$ ,  $MSE = 1.09$ ,  $p < .001$ ,  $\eta^2 = .72$ . The two interactions that involved test occasion, treatment by test occasion and ability by test occasion, were reported above.

**Problem Type.** The overall mean scores for problem type were 4.23 (71%) for the six personalized problems and 3.97 (66%) for the six non-personalized problems, a statistically significant difference,  $F(1, 132) = 17.63$ ,  $MSE = .51$ ,  $p < .001$ ,  $\eta^2 = .12$ . The ANOVA also yielded a significant two-way interaction for treatment by problem type,  $F(1, 132) = 4.66$ ,  $MSE = .51$ ,  $p < .05$ ,  $\eta^2 = .03$ . This interaction reflected the fact that there was a rather small difference in the scores of subjects in the personalized treatment on the personalized and non-personalized problems (4.29, or 72%, on personalized items and 4.16, or 69%, on non-personalized items), and a larger difference in the scores of non-personalized subjects on these items (4.16, or 69%, on personalized items and 3.77, or 63%, on non-personalized items). Post hoc paired-samples t tests of the scores contributing to this interaction revealed that the mean score of 3.77 for non-personalized treatment on non-personalized items was significantly lower at the  $p < .01$  level than the means of each of the other three groups.

Both personalized and non-personalized problems were included in the pretest in order to determine whether students would perform better on personalized word problems than on non-personalized problems prior to the instruction. The significant main effect for problem type across test occasions indicates that subjects did perform better on personalized items than on non-personalized items both before and after they received instruction. Paired-sample t tests of the difference between scores on personalized and non-personalized items on the pretest and again on the posttest confirmed that significant achievement differences favoring personalized items occurred on both occasions.

## Student Attitudes

The mean attitude scores by treatment and ability level for subjects' responses to the eight statements on the four-point Likert-type attitude survey administered after completion of the instructional program are shown in Table 2. Responses were scored as 4 for the most positive response to 1 for the most negative response.

The overall mean score across the eight Student Attitude Survey items was 3.42, a favorable rating indicating agreement with positive statements about the instructional program. The three highest-rated statements on the survey were "I learned a lot from this program" ( $M = 3.71$ ), "It is important to know how to solve two-step math problems" ( $M = 3.68$ ), and "I would like to do more math word problems like the ones in the program" ( $M = 3.55$ ). The lowest-rated statement was "I am able to do two-step math problems well" ( $M = 3.12$ ).

The data in Table 2 were analyzed using a 2 (treatment) x 2 (ability) x 8 (survey items) MANOVA to test for significant differences. A significant overall effect across the eight items was obtained for treatment, ( $M = 3.52$  for personalization and 3.31 for non-personalization),  $F(8, 127) = 7.10$ ,  $MSE = .13$ ,  $p < .001$ ,  $\eta^2 = .08$ , and for ability, ( $M = 3.54$  for higher-ability students and 3.29 for lower-ability students),  $F(8, 127) = 5.72$ ,  $MSE = .13$ ,  $p < .001$ ,  $\eta^2 = .11$ . The treatment by ability level interaction across the eight items was not statistically significant.

Univariate analyses on the eight survey items by personalization level revealed significantly more positive attitudes on four of the items for subjects in the personalized treatment than for those in the non-personalized treatment. Students in the personalized treatment had significantly more favorable scores at the  $p < .001$  level on the items: "This program was interesting" ( $M = 3.62$  for personalization and 3.24 for non-personalization,  $\eta^2 = .09$ ),

“This program was easy” ( $M = 3.50$  for personalization and 2.85 for non-personalization,  $\eta^2 = .19$ ), and “This program had many familiar persons, places, and things” ( $M = 3.62$  for personalization and 3.13 for non-personalization,  $\eta^2 = .11$ ), and at the .05 level on the item “I would like to do more math word problems like the ones in the program” ( $M = 3.66$  for personalization and 3.44 for non-personalization,  $\eta^2 = .04$ ).

Univariate analyses for ability level revealed significant attitude differences favoring higher-ability students on five of the items. Higher-ability students responded significantly more positively than lower-ability subjects at the .001 level to the statements: “I learned a lot from this program” ( $M = 3.91$  for higher ability and 3.51 for lower ability,  $\eta^2 = .14$ ), and “I am able to do two-step math problems well” ( $M = 3.35$  for higher ability and 2.88 for lower ability,  $\eta^2 = .11$ ), and at the .05 level to the statements: “This program was easy” ( $M = 3.32$  for higher ability and 3.03 for lower ability,  $\eta^2 = .04$ ), “I liked this program” ( $M = 3.44$  for higher ability and 3.12 for lower ability,  $\eta^2 = .05$ ), and “I would like to do more math word problems like the ones in the program” ( $M = 3.68$  for higher ability and 3.43 for lower ability,  $\eta^2 = .05$ ).

The frequency of constructed responses on the attitude survey to the two open-ended questions about what students liked most and what they liked least was also tabulated. Student responses indicated that what they liked most was that the program was interesting, a response given by 42 of the 136 students (31%). The second most common response to what students liked most was the use of the names of cartoon characters, persons, and things with which they are familiar, a response indicated by 38 students (28%). When asked what they liked least about the program, 48 students (35%) indicated nothing and 33 students (24%) responded that the lesson was too difficult.

*Table 2*  
*Student Attitude Scores by Treatment and Ability Level*

Item	Treatment			Ability		
	Pers	Non-Pers	F	Higher	Lower	F
1. It is important to know how to solve two-step math problems.	3.65	3.72	.57	3.72	3.65	.57
2. This program was interesting.	3.62	3.24	13.24**	3.40	3.46	.29
3. This program was easy.	3.50	2.85	31.00**	3.32	3.03	5.41*
4. This program had many familiar persons, places, and things.	3.62	3.13	15.81**	3.49	3.26	2.99
5. I learned a lot from this program.	3.69	3.74	.22	3.91	3.51	20.85**
I am able to do two-step math problems well.	3.16	3.07	.52	3.35	2.88	16.65**
I liked this program.	3.28	3.28	.00	3.44	3.12	6.29*
I would like to do more math word problems like the ones in the program.	3.66	3.44	4.81*	3.68	3.43	6.26*
<b>Overall means</b>	3.52	3.31	10.83**	3.54	3.29	16.00**

\* $p < .05$ . \*\* $p < .01$ .

## Teacher Attitudes

The overall mean teacher rating on the six items on the Teacher Survey was 3.71, a favorable rating indicating strong agreement with positive statements about the instructional program. All four respondents agreed very strongly ( $M = 4.00$ ) with three statements: “Personalization was a good teaching strategy”, “I liked the personalized version of the program”, and “I would enjoy teaching a personalized lesson to my students occasionally.”

On the one open-ended question on the survey, “Please make any comments or suggestions that you would like to make about this instructional program,” two teachers indicated that making math word problems more personalized increases students’ motivation and interest. One teacher reported that the students would understand the personalized problems better because they could relate the information in the problems to their real-life situations and “shorten the distance” of their thinking patterns on the problems.

## Discussion

The primary research question in this study addressed the issue of whether personalization of instruction increases the achievement of Taiwanese students on mathematics word problems. The treatment by test occasion interaction revealed that the personalized treatment did, in fact, result in significantly higher pretest-to-posttest gains than the non-personalized treatment. This positive finding for personalization of instruction is consistent with the results obtained in several studies of personalized mathematics instruction in the United States (Anand & Ross, 1987; Lopez & Sullivan, 1991, 1992). It differs from the overall result for personalization in the earlier study by Ku and Sullivan (2000) in Taiwan, in which a ceiling effect limited the potential gain of higher-ability fifth-graders.

The strategy of conducting this study with fourth-grade students, instead of fifth-graders as in the earlier study, had the desired result of reducing the strong ceiling effect observed previously (Ku & Sullivan, 2000). Despite the successful effort to reduce the ceiling effect with higher-ability students in this study, the significant ability level by test occasion interaction revealed that this effect was not completely eliminated. Higher-ability subjects averaged 95% (11.35 of 12 correct) on the posttest. This represented only 17% gain over their pretest score of 78%, but nevertheless approached the maximum possible score on the test. In contrast, lower-ability subjects were able to make a much higher gain, due in part to their much lower pretest score of only 31%.

The significant overall improvement from 55% on the pretest to 82% on the posttest indicated that the instructional program itself was generally effective across all treatment groups. This increase in scores occurred over an average time period of only about 53 minutes of instruction and review. In addition, the fact that students averaged 83% on the practice items and 82% on the posttest indicates that they retained their learning quite well from the instructional phase of the study to the final testing phase.

The finding that students scored higher on personalized test items than on non-personalized items, even prior to instruction (i.e., on the pretest), has potential implications for mathematics assessment. Certainly this finding merits further investigation in other settings and with larger samples to determine its consistency and generality. However, it suggests that students generally may score higher on math problems that include more familiar or personalized settings than on problems with unfamiliar or non-personalized settings. If that is the case, test developers who write standardized and criterion-referenced mathematics tests may want to consider the appropriateness of using settings for their problems that are generally familiar or popular with the projected test population.

The attitude data clearly indicated students’ preference for personalized instruction, a result consistent with the findings in previous studies (Ku & Sullivan, 2000, Lopez & Sullivan, 1992, Ross & Anand, 1987). The strongest differences, all at the .001 level, were on items stating that the program was interesting; the program had many familiar persons, places, and things; and the program was easy. The first two of these statements reflect the intended nature of a personalized program and the third is consistent with the explanation that personalization may make learning easier by reducing subjects’ cognitive load. Personalized subjects also agreed significantly more strongly ( $p < .05$ ) that they would like to do more math word problems like the ones in the program, a statement that suggests greater continuing motivation or willingness to return-to-task on their part. In general, the significant differences on these particular items support the claimed motivational and learning advantages of personalization.

Several significant differences between ability levels on the attitude survey also reflected differences that one might expect between higher-ability and lower-ability students. Higher-ability students agreed more strongly that they learned a lot from the program ( $p < .001$ ), that they were able to do two-step math problems well ( $p < .001$ ), and that the program was easy ( $p < .05$ ). These items appear to be the ones in the survey that were most

closely associated with ability level. In contrast, higher-ability and lower-ability subjects did not differ significantly in their responses to items that logically seem to be less associated with ability.

This study was not designed as a test of theoretical explanations for the effects of personalization. However, certain data from the teacher and student surveys tend to support the “increased interest” and “reduced cognitive load” explanations described in the introduction section of this paper.

The present results were obtained using group personalization in a low-technology environment that is typical of the schools in Taiwan and in many other countries. A basic use of personalization, or interest-based instruction, in such settings is for teachers to make a conscious effort to learn their students’ interests and to incorporate them regularly into their instruction. Teachers can supplement their existing knowledge of student interests by using an interest survey, as was done in the present study, and/or by holding occasional discussions with their students about current topics and events that may be popular with them.

## **References**

- Anand, P. G., & Ross, S. M. (1987). Using computer-assisted instruction to personalize arithmetic materials for elementary school children. *Journal of Educational Psychology*, *79*(1), 72-78.
- Cordova, D. I., & Lepper, M. R. (1996). Intrinsic motivation and the process of learning: Beneficial effects of contextualization, personalization, and choice. *Journal of Educational Psychology*, *88*(4), 715-730.
- D’Ailly, H. H., Simpson, J., & Mackinnon, G. E. (1997). Where should “you” go in a math compare problem? *Journal of Educational Psychology*, *89*, 562-567.
- Davis-Dorsey, J., Ross, S. M., & Morrison, G. R. (1991). The role of rewording and context personalization in the solving of mathematical word problems. *Journal of Educational Psychology*, *83*(1), 61-68.
- Dwyer, H. J. (1996). Effect of personalization on reading comprehension. (Doctoral dissertation, Arizona State University, 1996). *Dissertation Abstracts International*, *59*, Z3810.
- Enright, B. E., & Choate, J. S. (1993). Mathematical problem solving: The goal of mathematics. In J. S. Choate (Eds.), *Successful mainstreaming: Proven ways to detect and correct special needs* (pp. 283). MA: Allyn and Bacon.
- Hart, J. M. (1996). The effect of personalized word problems. *Teaching Children Mathematics*, *2*(8), 504-505.
- Herndon, J. N. (1987). Learner interests, achievement, and continuing motivation in instruction. *Journal of Instructional Development*, *10*(3), 11-14.
- Ku, H-Y, & Sullivan, H. J. (2000). Personalization of mathematics word problems in Taiwan. *Educational Technology Research and Development*, *48*(3), 49-59.
- Lopez, C. L., & Sullivan, H. J. (1991). Effects of personalized math instruction for Hispanic students. *Contemporary Educational Psychology*, *16*(1), 95-100.
- Lopez, C. L., & Sullivan, H. J. (1992). Effect of personalization of instructional context on the achievement and attitudes of Hispanic students. *Educational Technology Research and Development*, *40*(4), 5-13.
- Mayer, R. E. (1982). Memory for algebra story problems. *Journal of Educational Psychology*, *74*(2), 199-216.
- Mayer, R. E. (1998). Cognitive, metacognitive, and motivational aspects of problem solving. *Instructional Science*, *26*(2), 49-63.
- Miller, D. C., & Kulhavy, R. W. (1991). Personalizing sentences and text. *Contemporary Educational Psychology*, *16*(3), 287-292.
- National Assessment of Educational Progress. (1992a). *NAEP 1992 mathematics report card for the nation and the states*. Washington, DC: National Center for Education Statistics. Report No. 23-ST02.
- National Assessment of Educational Progress. (1992b). *NAEP 1992 school effects on educational achievement in mathematics and science*. Washington, DC: National Center for Education Statistics, Research and Development Report.
- Rosen, D. R. (1984). *Students’ schemata for algebra word problems*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.
- Ross, S. M. (1983). Increasing the meaningfulness of quantitative material by adapting context to student background. *Journal of Educational Psychology*, *75*(4), 519-529.
- Ross, S. M., & Anand, P. G. (1987). A computer-based strategy for personalizing verbal problems in teaching mathematics. *Educational Communication and Technology Journal*, *35*(3), 151-162.

Ross, S. M., McCormick, D., & Krisak, N. (1986). Adapting the thematic context of mathematical problems to student interests: Individualized versus group-based strategies. Journal of Educational Research, 79(4), 245-252.

Ross, S. M., McCormick, D., Krisak, N., & Anand, P. G. (1985). Personalizing context in teaching mathematical concepts: Teacher-managed and computer-assisted models. Educational Communication and Technology Journal, 33(3), 169-178.

# Transitioning Instruction From Face-to-Face To Distance Learning: Factors To Consider in Planning For The Migration

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## Abstract

*With the increasing use of web-based instruction in universities, faculty are being asked to transition courses from the classroom to the web. Migrating a course requires planning that includes changes in the instructional strategy and communications strategy that many faculty might not consider. This process is particularly challenging for instructors teaching their first online course. The contents of this paper grew out of an experience in transitioning a course from face-to-face delivery to web-based delivery. It represents challenges that emerged and offers recommendations for making the transition easier for faculty and students.*

## Introduction

With the explosion of web-based technology and the resultant increasing demand for web-based courses, many faculty members are faced with teaching their first online course. For these faculty, and others, the use of technology to deliver instruction can lead to course management issues that are unplanned for and result in challenges that are unexpected. Some of the challenges that have been reported in the literature are related to the need to change the approaches to instruction and interaction in order to make them more effective for the online environment (Pajo & Wallace, 2001; Boettcher & Conrad, 1999; Leh & Som, 1999). An additional challenge to transitioning is the time associated with using and monitoring the web-based environment (Pajo & Wallace, 2001; Daugherty & Funke, 1998). It is suggested that preplanning to augment a course to meet the requirements of the new delivery system might ease the transition for faculty. This paper presents factors that emerged from reflections from a transitioning experience. It recommends methods for making the transition easier for faculty.

## The Experience

The insights and recommendations presented in this paper stem from an experience in teaching a course transitioned from face-to-face to the web. The course, Introduction to Instructional Systems Design (ci3.acns.fsu.edu/courses/EME 5603-01) was transitioned in the Fall Semester of 2000. This course is one of the corner stones of the Masters Degree program in Instructional Systems at Florida State University. The face-to-face course is well designed for an optimal student experience. It has been formatively evaluated and revised over many years. It is a product-based course that is structured to provide an intensive, highly individualized opportunity for students to develop, formatively evaluate, and revise their own instructional module. The web-based version of this course was designed to mirror the face-to-face class. All assignments were the same, the approach to the students was the same, and the products required were the same. The students were adult learners located in Virginia, Oklahoma, Georgia and Florida. Most of them work in corporate environments as trainers. Their final projects were of equal quality to the face-to-face class and the course was viewed as a valuable experience for both students and the instructor in terms of providing the flexibility of time to teach and learn and opportunities for high quality interaction.

While the course worked, the process created some potential threats to instructional effectiveness such as the additional instructional load. Factors that were major concerns in relation to the transition were: 1) translation of the from face-to-face directly to the web, 2) the highly individualized nature of the assignments and the resultant frequent formalized student- to- instructor interaction, without significant student-to-student interaction, and 3) the time management issues regarding managing and monitoring the course delivered via the web.

## Factors to Consider

This experience suggested factors that faculty may consider in transitioning a course from face-to-face to the web. Such factors might be planning for the migration by 1) adapting the instructional strategy to change the

course from teaching focused to learning focused, 2) developing a time management strategy for communicating effectively with students regarding issues of course content, course assignments, technical matters related to the course site, and sending and receiving assignments, and 3) obtaining support from the university for online facilitation. Recommendations are presented related to each of the three factors.

## **Recommendations**

In terms of adapting the approach from teaching to learning, the instructor might reconfigure activities that work in the face-to-face classroom to achieve the desired learning outcome in a web-based environment. In adaptation for interaction in the web-based environment, the key in this adaptation is balanced interaction. Boettcher and Conrad suggest that student-to-student interaction should represent 40% of the total interaction in the course. The remaining 60% is divided between instructor-student and student-content interaction, with more focus on instructor-to-student interaction. Adapting the interaction to promote learning on the web, should increase student interest in the course and student satisfaction with the course (Leh and Som, 1999). In adapting the course, the instructor should consider using methods of synchronous and asynchronous interactions between student groups of various sizes. Synchronous interactions may include online chats or small group meetings and telephone calls. Asynchronous interactions may include online seminars, multimedia presentations, e-mail and discussion boards. The methods used will depend on the goals of the course, faculty choice of interaction method and student choice of interaction method (Boettcher & Conrad, 1999). Adapting the course to allow for more balance in the types of interaction should increase the effectiveness of a transitioned course in achieving learning outcomes.

Time management is a major issue for faculty transitioning a course from face-to-face to the web-based instruction. It is essential that faculty plan to structure their time to accommodate the needs of students at a distance. This involves planning to check daily for student emails, craft emails to respond to student emails, check discussion boards for student questions follow-up with students who fail to participate, address students needs for additional information regarding course content, address group issues dealing with technical questions about using the course site, and send and receive assignments. These aspects of teaching an online course may be familiar to online veterans and many of these issues may translate readily from the classroom to the web. However, for the novice, the distance sometimes complicates completion of simple tasks. For example, communication that might take place at the end of class or in the office may take much longer to complete effectively online. Technical issues related to using the course delivery system may compete for faculty attention in teaching the course. Additionally, sending and receiving assignments may be complicated by the technology. In sum, a course taught at a distance may require more of the instructor's time than a face-to-face course. Faculty and administrators should be aware of this when considering assigning duties and responsibilities that involve a transition of this kind.

Planning to address course management issues can be alleviated through additional support from the university. The addition of a mentor/facilitator would assist in changing the focus of the instruction from teaching to learning (Moore & Kearsley, 1996). This facilitator could assist in addressing many of the course management issues that affect instructor time. He/she could also help in creating the learning environment, facilitating communication to ensure a smooth student experience in the course by responding to emails, checking discussion boards and solving technical problems. This would free the instructor's time to focus on more substantive issues related to achieving learning outcomes. This kind of support would appear to ease the transition from face-to-face to the web.

## **Conclusion**

In conclusion, the growth in the use of the web for delivery of instruction has led universities to increase expectations that faculty will transition courses from face-to-face delivery to web-based delivery. To facilitate effective transition, faculty should plan to address course management issues by: 1) adapting their courses from a teaching to a learning focus, 2) structuring their time to accommodate the additional demands of teaching an online course, and 3) obtaining additional support from the university to facilitate the learning environment. These recommendations address issues that may assist faculty in planning to transfer a course from the classroom to the web. The discussion of the impact of transitioning on faculty will surely continue as demands for web-based course offerings increase and more faculty respond by transitioning courses to web-based delivery.

## **References**



Boettcher, J. & Conrad, R.M. (1999). *Faculty Guide for Moving Teaching and Learning to the Web*. Laguna Hills, CA: League for Innovation in the Community College.

Daugherty, M. & Funke, B.L. (1998). University faculty and student perceptions of web-based instruction. *Journal of Distance Education*, 13 (2), 21-39.

Leh, A. & Som, Y.M. (1999). Challenges and Considerations When Conducting an Online Course. Paper presented at Society for Information Technology & Teacher Education International Conference (10<sup>th</sup> San Antonio, TX, February 28 – March 4, 1999)

Moore, M.G. & Kearsley, G. (1996). *Distance Education: A Systems View*. New York: Wadsworth Publishing Company.

Pajo, K. & Wallace, C. (2001). Barriers to the Uptake of Web-Based Technology by University Teachers. *Journal of Distance Education*. 16 (1), 70-84.

# **Brownfield Action: An Integrated Environmental Science Simulation Experience for Undergraduates**

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## **Objectives**

The purpose of this paper is to present the results of three years of development and evaluation of a cd-rom/web hybrid simulation known as Brownfield Action for an introductory environmental science course at an independent college for women located in a large city in the northeastern USA.

## **Perspectives**

Science courses often struggle to link the material in lecture and laboratory for many reasons. Laboratories are often taught by different personnel, and must fit into constraints of equipment and time, as well as safety and level of difficulty. A large survey course may cover dozens of topics, whereas a student typically experiences no more than fifteen laboratory periods in a given semester. Larger than these logistical issues is the student's mindset in each environment. Life science lectures require rapid note taking and passive concentration as verbal information is drilled at students for anywhere from one to two hours. Laboratory sessions typically require two to three hours of recipe-following and occasional problem solving. These two functions operate in isolation because there is little time in lecture to discuss experimental technique (if the lecturer even knows that information) and a laboratory is not typically set up for someone to give verbal instruction as occurs in the lecture hall. But more than these aspects, typical science students spend most of their time memorizing verbal information for lecture exams, and memorizing techniques, anatomy, and taxonomies for laboratory practical examinations. Rarely is information from one used in the other simply because the lecture focuses on concepts while the laboratory teaches technique. Students often walk away from a course feeling as if it were two courses and fail to get a sense of the content as a whole.

Simulations provide the ability to integrate content into a complex problem that students can explore. The closest work to the experience of the Brownfield Action design and development process can be seen in Goodrum, Dorsey, and Schwen's work on defining and designing Enriched Learning and Information Environments (ELIEs) (*Educational Technology* November 1993). In this paper, the researchers describe how their experience with designing educational environments led them away from entirely technology-based and theory-based definitions and more towards what they define as a socio-technical definition that focuses on the people involved and the specific work they are asked to perform. They perceive that the latest learning theory and the latest technology does not lead to innovation, but instead that all innovations are situated within a context of people trying to accomplish work in a particular environment, and a well-designed teaching and learning tool should support that work. They go on to describe their design work as a series of relationship building with users, rapid prototyping with mock-ups and a focus on the tasks that users needed to perform. The Brownfield Action project follows a similar model.

## **Methods**

Columbia University's Center for New Media Teaching & Learning (CCNMTL) developed and implemented a cd rom/web hybrid simulation known as Brownfield Action in the Fall of 1999 and again in the Fall of 2000 at an independent college for women located in a large city in the northeastern USA, which models how an undergraduate Environmental Science course can directly integrate its lecture and laboratory components. Through presenting students with a complex problem that requires the application of knowledge and skills learned in lecture and in the laboratory setting, performance and engagement is improved, and students experience environmental science as a highly integrated field while developing real-world problem solving skills. Rather than reserving higher level thinking skills such as analysis and synthesis for smaller, more advanced courses, Brownfield Action allows introductory students to see environmental science as an integrated and dynamic part of society, rather than a series of abstract concepts and recipe-driven techniques.

Brownfield Action is a simulation that provides a learning environment for developing the skills of an environmental site investigator by placing students in a virtual town and asking them to serve as consultants to a real estate developer who wants to avoid purchasing potentially contaminated land. Students must become actively involved in the lecture and laboratory in order to succeed. They must learn to explore and discover a path to a solution to the problems they encounter and work collaboratively with a partner in order to reach a valid conclusion.

Pairs of students form environmental consulting companies to investigate a hypothetical abandoned factory site in a small town. A mall developer who wishes to purchase the factory site contracts with each two-student company to conduct an investigation, write a report recommending a course of action, and construct maps of the site's basic geology, topography, and any contamination they discover.



Figure 1. A screen capture of the site map in the historical section of the application. The user is preparing to interview the owner of the local nursery in the town.

To complete the maps and report, students must first gather a site history from the town's resources. Through the simulation, students visit government offices, businesses, and residences to conduct interviews with town's officials and citizens and to obtain public documents (Figures 1 and 2).



Figure 2. A screen capture of the municipal directory where students visit government offices. The user is interviewing the township mayor.

Using the information obtained from the town's history, students then conduct a series of environmental tests to determine the presence, extent, and probable cause of any contamination. Some tests, such as soil

permeability, are conducted as traditional laboratory exercises placed within the context of the simulation. Other tests, such as well monitoring, are conducted virtually using the computer. Over two million data points are available for collection over the 64,000 square foot virtual site map, including bedrock and water table data as well as contamination concentrations at depths of over 150ft. This vast quantity of data, both through the site history and the environmental testing, allows for an infinite number of strategies for testing and a unique data set for every student company. Successful students work within the given operating budget and clearly identify the cause and extent of the contaminated areas on the site.

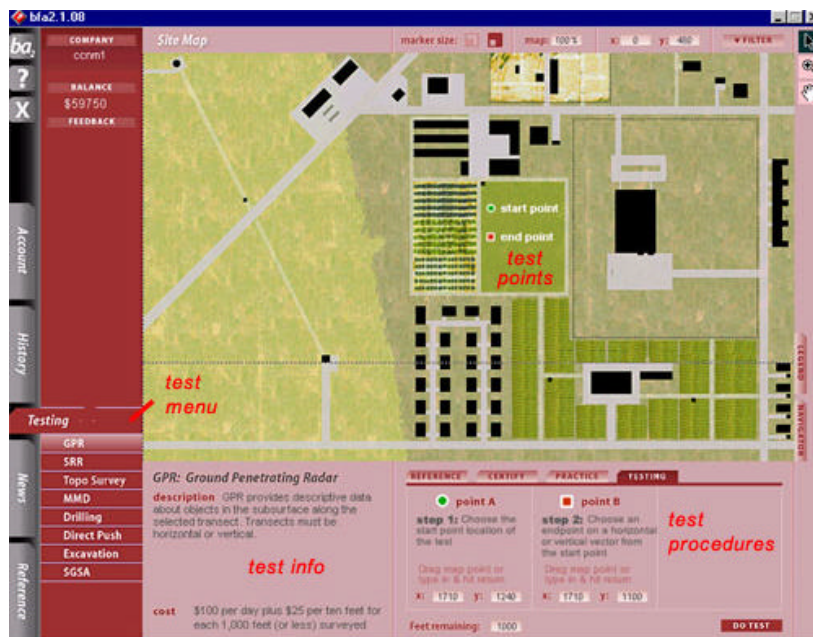


Figure 3. A screen capture of the testing interface. The user is preparing to use the Ground Penetrating Radar test on the Site Map.

Brownfield Action is not intended as a cost-cutting measure, a time-saver, or a replacement for other material, but as a method of integrating what was formerly disparate labs and lectures into a seamless learning experience that improves student learning and motivates students to critically consider the importance of all the issues involved in the system of human impact on the environment.

The primary faculty member, serving also as the subject matter expert, identified the following objectives:

After experiencing Brownfield Action, students will be able to explain how to approach and solve a scientific problem by:

- describing the strategy used to discover contamination sites in Brownfield Action;
- identifying and explaining the outcomes of environmental tests they conduct and related information, making recommendations and being aware of the consequences of their decisions;
- drawing inferences from data about structures that contribute to environmental contamination;

and students will:

- read articles on ecology with different understanding, interest, and personal commitment;
- appreciate that real world decision-making about ecology involves ambiguity rather than certainty.

To assess the effectiveness of the second version of Brownfield Action (BfA2.0) that ran in the Fall of 2000 in meeting its objectives, students were surveyed at the beginning of the simulation to obtain an indication of their perceptions of the levels of knowledge and skill targeted by the course with which they started. The laboratory directors prepared a daily implementation log providing detailed documentation of the BfA2.0 experience in the labs. The evaluators observed five lectures and six of the three-hour labs to further their understanding of the instructional setting within which the Brownfield Action simulation was conducted. At the end of the course, students rated Brownfield Action on how well it had contributed to the objectives of the course and other matters,

and all students participated in hour-long focus groups to provide in-depth responses to questions not amenable to discovery through written survey questionnaire. The evaluators also conducted hour-long, post-course interviews with the lead designer of the simulation; the primary faculty member (subject matter expert), and the laboratory directors. Finally, a cross section of the papers prepared by BfA2.0 students was reviewed and compared with student papers from previous years.

### Data Sources

The entire course of one hundred and twelve female students were surveyed using two questionnaires (one at the beginning of the semester, one at the end) and a series of focus groups at the end of the term (one for each of the eight lab sections).

In the survey questionnaire and focus groups we investigated students'

- perceptions of pre- and post-test levels of their knowledge;
- perceptions of the success of BfA2.0 in meeting its objectives;
- perceptions of the contributions of various components of BfA in assisting them to solve the overall problem addressed by BfA2.0, and how well BfA2.0, the lectures and the lab succeeded in directing them to focus on the major problem addressed by BfA2.0.
- overall evaluation of BfA2.0, positive and less positive;
- recommendations for technical improvements in BfA2.0;
- perceptions of the most valuable parts of BfA2.0;
- perceptions of what could be done to improve BfA2.0.

The evaluation team also examined students' final reports in accordance with the learning objectives outlined by the primary faculty member as well as the daily laboratory implementation log prepared by the laboratory directors.

### Summary of Results

- Students learned more and in greater depth using Brownfield Action than in previous years without it.
- Student work looked more authentic and professional, closer to what would be expected of a professional performing these tasks.
- Students appreciated how the simulation contributed to their understanding of the material.
- Brownfield Action was successful in (1) enhancing the scientific literacy of students, (2) facilitating their construction of new meaning based upon what they saw and experienced and (3) enhancing practices leading to increased student learning.
- Students' abilities to construct new meaning based upon what they saw and experienced were expanded.
- Students found the content useful and the simulation a good way to learn it.
- More staff development is necessary to foster the teaching strategies needed for a true discovery process and to build comfort with technology.
- Minor technical glitches created levels of frustration that interfered with its ability to meet its educational potential. These glitches notwithstanding, the students gave high ratings to other features of the technology. In particular, eight out of ten students noted the ease with which it was possible to move through information in each of the sections of the simulation.

### Discussion

The simulation in the context of Brownfield Action is not just in the technology, but in the classroom environment set up around and supported by the technology. The simulation is in the course curriculum, the faculty member, the lab directors, and the students, and it only becomes a simulation once all of these factors work in parallel. For as long as there has been computing, many have tried to *simulate* aspects of reality with computing power, but the reality is that all that has been built to date might be better called *simulators*. Simulators model real-world processes with mathematical equations and variables that can be manipulated so that changes can be observed and analyzed. The software for Brownfield is no different upon close inspection. It is a model of a town with a

mathematically driven contamination event that occurs within a narrative, but the narrative does not exist without the students fulfilling their role as investigators. In other words, the story does not get carried out unless the students and faculty pursue their roles and fulfill their tasks, or in effect, write their parts of the story as they interact with the simulator. Brownfield Action could be run in a classroom without any technology at all, and in fact it was done on a smaller scale for many years using an elaborate note card scheme. The computer software supports the expansion of the simulation created in the classroom, giving it a visual space, a more efficient process for collecting data, a means for communication, and more definition and depth (literally and figuratively) to the environment that is to be examined. The software itself does not teach. Instead it invites the user to engage in the problem. To foster engagement, one needs motivation and a safe space to take risks, and that is where the surround, the classroom, the curriculum, and the instructors come in to play.

Simulations can be powerful teaching and learning environments because operating in the real world is not really all that different from participating in a simulation. Everyone has roles to play in the real world (probably more than one), and there are problems, conflicts, and obstacles to be encountered and overcome in each of those roles. The method for overcoming these problems is in communication and experimentation, which includes hypothesizing, collecting data, analyzing, synthesizing, and applying previous discoveries with other role players using the tools that are available. One of the tools available in Brownfield Action is the software, but there are also physical maps, soil samples, reference material, and other similar narratives such as *A Civil Action*, a novel all students in the course read. Most any profession is going to place people in a similar situation and demand the same action from its participants. Brownfield Action provides a safe environment, away from the consequences of the real world – the money involved isn't real, one's job isn't at stake, etc... - so students can essentially practice living in the real world by immersing themselves in the problem to be solved in the simulation.

As outlined in studies such as Sandholtz's *Teaching with Technology: Creating Student-Centered Classrooms*, instructors need to phase out traditional directed or didactic teaching techniques and work towards more guiding and exploring strategies for teaching with technology to be most effective. This has proved true with Brownfield Action as well, so in preparation for this year's course, we instituted more staff development for the laboratory directors to assist them in improving their instructional techniques as well as a study guide to aid students in orienting themselves to the project.

All known technical glitches from last year's experience have been remedied for this year's course, but minor problems may continue to appear as they would with any project of this magnitude. Over time the instructors and support staff will only get more accustomed to the common problems students experience, so the effects of these problems should be minimal.

All in all, the project has proved successful in providing students with a more integrated science experience than in traditional classrooms and CCNMTL (<http://cnmtl.columbia.edu>) looks forward to developing more simulation models for teaching and learning based on this project.

## References

Goodrum, Dorsey, and Schwen (1993) "Defining and Building an Enriched Learning and Information Environment," *Educational Technology*, 33(11):10-20.

Sandholtz, Judith (1997) *Teaching with Technology: Creating Student-Centered Classrooms*, New York, NY: Teachers College Press.

# **Pre-Kindergarten through Grade Twelve Web-based Science Course of Study**

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*This rapid prototype web-based Pre-Kindergarten through Grade Twelve Science Course of Study is being developed by teachers for student and is based on state standards. It is organized by strand and grade level using benchmark state proficiency outcomes and competencies as framework. Best practice activities, assessments, and resources are correlated to student outcomes. Since the Ohio Department of Education is in transition from the current instructional model to academic content standards, this course of study is an ongoing endeavor that will be revised and updated to reflect current best practice based on student results as new assessments and diagnostic tools are developed.*

## **Design**

### **Needs Assessment**

During the spring of 1999, two science consultants from the Mid-Ohio Educational Service Center (MOESC) surveyed science teachers and administrators in the eighteen school districts within the tri-county service area to determine their needs for the upcoming science course of study. Respondents to the survey indicated the following design criteria: web-based, interactive, a dynamic document, functional, user friendly, and resource rich. (MOESC, 1999)

### **Rapid Prototype Instructional Design Model**

Initial design was determined by a committee consisting of teachers from all participating districts and a team of science consultants from the educational service center. A three-year design, development, and implementation process had been planned prior to the recruitment of the teacher team. The print version was to be completed by August 2000 for delivery to teachers that fall. Since the timeline was short, a rapid prototype needed to be developed. Jones and Richey (2000) state that rapid prototyping methodology "encourages communication between everyone concerned with the effort. Subject matter experts assist in content identification throughout the project. End-users react to the prototype to provide feedback regarding the design, instructional activities, and user interface." This should satisfy customers, in this case, science teachers, "because they are involved in an extensive formative evaluation of the actual product throughout its design and development."

Feedback during this phase of development was provided through a listserv as the components were loaded to the web. "Prototyping is defined by Tessmer (1993) as a hybrid of formative evaluation and design activities." (Seels & Glasgow, 1999, p. 150) Seels and Glasgow provide two reasons for developing a prototype. First, the designer may have questions about the student's ability to learn from and use the new system. Secondly, when a new technology is involved there may be questions about the design team's experience with new ways of doing things. Prototype development allows the client to assess the cost effectiveness of the new system and allows the design team the opportunity to learn new skills in an environment where the consequences are less expensive. (p. 151)

A web site was devoted strictly to the design phase of the course of study. E-mail addresses of team members were compiled and notice of the addition of new components was immediately sent to the committee for their review and subsequent formative evaluation of the component being appraised. Changes or improvements were made by posting any suggestions, waiting for responses, and subsequently making the adjustments.

### **Organization of the Course of Study**

The Table of Contents was the initial component to be created, since the *Ohio Model Competency-Based Science Program* provided a diagram "to communicate the structure and relationship of components of a local science curriculum...." (Ohio Department of Education [ODE], 1994, p. 8) Each component added was linked to the text descriptors in the Table of Contents. Links to the *National Science Education Standards* and the *Benchmarks*

for *Science Literacy* were created early in the process to provide the committee with research based reference material on which to formulate decisions regarding the components to be created thereafter. A few teachers who devoted extra time to the creation of the Ohio Model science curriculum components earned university credit. These were e-mailed to the designer, converted to web pages, and loaded to the web site for review by the remainder of the committee.

### **Grade Level Templates**

The most crucial and problematic design issue proved to be the grade level templates. Student performance data for the science portion of the Ohio Proficiency Tests are reported according to seven categories as defined by the *Ohio Model Competency-Based Science Program*. Proficiency test learning outcomes “are grouped into four strands - Nature of Science, Physical Science, Earth and Space Science and Life Science.” (ODE, 1994, p. 117) and three Performance Objective Levels of Understanding: “Acquiring Scientific Knowledge – observing, collecting, and recording data and information from various sources; Processing Scientific Knowledge – organizing, interpreting, manipulating, and reformulating observations and data;” and “Extending Scientific Knowledge – applying, formulating, transforming, and communicating ideas in a variety of contexts.” (ODE, 1994, p.111) The difficulty with this, however, is that the Ohio Model is organized into the following four instructional strands: Scientific Inquiry, Scientific Knowledge, Conditions for Learning Science, and Applications for Science Learning. (ODE, 1994, pp. 19-22) and performance objectives that “have been constructed by considering the instructional objectives from all four instructional strands....” (ODE, 1994, p.23) “School science committees should use their grade-level instructional objectives and the examples of performance objectives in the model to create district performance objectives for the local science curriculum.” (ODE, 1994, p. 17)

### **Arriving at the Framework**

Since proficiency results are made public, it is by those criteria that effectiveness of science programs is demonstrated. In order to improve student performance, the templates were designed by proficiency outcome by strand and grade level. Icons were chosen to represent the strands of the learning outcomes.

Work had been done at an educational service center in the southeastern part of Ohio, Muskingum Valley Educational Service Center, to further clarify the meaning of the proficiency outcomes for teachers. (Muskingum Valley Educational Service Center, 1999) Their teacher inventories were adapted to frame the assessments and suggested activities and resources for the grade level templates. There was a meeting of the full committee and the template was accepted as the framework.

### **Development**

#### **Summer Session**

The development team attended a three-day summer session to research and add resources to the templates. Participants were provided with various forms of instructional materials, such as textbooks, literature, kits, periodicals, and electronic resources and received instruction on proper citation of materials and editing of web pages. The remainder of the time was spent incorporating the materials into the templates.

#### **Board Adoption**

The Governing Board of the Mid-Ohio Educational Service Center approved the Science Course of Study on July 24, 2000. In early August at an administrative retreat, the course of study was introduced and the print version was distributed to central office personnel. In early fall, a rollout of the course of study was held in each county in the service area and a print version customized to the grade level of the teachers was distributed. Teachers received their grade level and the one immediately preceding and following, along with the Table of Contents and other key components.

#### **Additional Formative Evaluation**

Districts began curriculum alignment at their own pace throughout the first semester of the 2000-2001 school year. At a high school principal's meeting in early winter where the course of study was being discussed,



principals expressed dissatisfaction with the initial design of the grades nine through twelve portion of the course of study. The template approach was not feasible with the discrete course offerings. Smith and Ragan (1999) have cited Tripp and Bichelmeyer, representing the idea that “the analysis of needs and content depends in part on the knowledge that is gained by actually building and using a prototype instructional system.” (p. 376) This negative feedback was entirely unexpected by the designer, who sought to find a solution that would satisfy the administrators and still serve the needs of the teachers who would ultimately be the end users.

Curriculum guides were submitted from all participating districts and templates for subject area courses were created based on the course descriptions. Pre-kindergarten through grade six teachers attended a seminar series: "Learn How to Use the New Science Course of Study," "Science Resource Vendor Fair and Children's Literature," and "Planning Your Science Instruction for 2001-2002." Grades seven through twelve teachers received orientation to the templates for the subject area courses. The nine through twelve course templates were further developed, including the addition of subcomponents to the topic areas of each discrete course. The existing web version was edited and teachers added the course requirements of each district and subsequently added resources to the developing courses. Additional resources were also added to the grades seven and eight courses.

## **Implementation**

### **Average Proficiency Test Performance**

Proficiency test results for the past three years on grades four and six proficiency tests were averaged for all districts. Over thirty percent of the students demonstrated average performance lower than the minimally proficient standard for the following science strands on the Fourth Grade Proficiency Test: Nature of Science, Physical Science, Earth & Space Science, Level of Understanding: Acquiring Knowledge, Level of Understanding: Processing Knowledge, and Level of Understanding: Extending Knowledge. An equal percentage demonstrated lower than the minimally proficient standard for the following mathematics strands on the Fourth Grade Proficiency Test: Numbers and Number Relations, Level of Understanding: Conceptual Understanding and Level of Understanding: Application & Problem Solving. Over thirty percent of the students demonstrated average performance lower than the minimally proficient standard for the following science strands on the Sixth Grade Proficiency Test: Nature of Science, Physical Science, Earth & Space Science, Life Science, Level of Understanding: Acquiring Knowledge, Level of Understanding: Processing Knowledge, and Level of Understanding: Extending Knowledge. An equal percentage demonstrated lower than the minimally proficient standard for the following mathematics strands on the Sixth Grade Proficiency Test: Problem Solving Strategies, Numbers and Number Relations, Geometry, Algebra, Estimation and Mental Computation, Data Analysis and Probability, Level of Understanding: Conceptual Understanding, Level of Understanding: Knowledge & Skills, and Level of Understanding: Application & Problem Solving. (MOESC, 2001)

### **Professional Development Needs Assessment**

In order to determine the professional development needs of the science and mathematics teachers in the participating districts, a Science and Mathematics Needs Assessment Survey was completed by 581 mathematics and science teachers in seventeen of the eighteen participating school districts. Four districts were chosen by the Mid-Ohio superintendent to participate in a Science and Mathematics Needs Assessment Interview to obtain more additional qualitative data. (MOESC, 2001) All administrators and central office personnel and twelve teachers per district, one from each grade level, were asked what they saw as the most immediate mathematics and science curriculum need in their district and why and what types of professional development they thought would address that need. They were also asked about possible content area activities and they types of resources that would help provide better mathematics and science instruction in their district.

The survey and interview data indicate that the following professional development opportunities are needed: searching techniques, integrating technology into the curriculum, alternative assessment, assessing the needs of the learners, analyzing proficiency data, curriculum alignment, and adaptations for special needs. The majority of teachers prefer that the sessions are two hours or one half day in length, either during early release or during the school day with a substitute. Most teachers would like to have work sessions with teachers at their own grade level or those just above or just below. The greatest majority expressed preference for meetings at the building level, followed by the district level. Stipends were the preferred type of compensation.

### **Ongoing Improvements**

Ohio is in transition from the current model to Academic Content Standards. The State Board of Education is scheduled to adopt the new standards in December 2002. (ODE, 2001) The new state curriculum model is due eighteen months later. The standards framework consists of Academic Content Standards, which the Ohio Department of Education defines as “What all students should know and be able to do; the overarching goals & themes.” Benchmarks are defined as “key checkpoints that monitor progress toward academic content standards.” Benchmarks are “identified by grade-level clusters/bands,” i.e., K-3, 4-5, 6-8, 9-12, that “will vary across content areas and align with achievement tests where applicable.” The Grade-Level Indicators provide “what all students should know and be able to do at each grade level” and can be used as checkpoints to “monitor progress toward the benchmarks.” (ODE, 2001)

## Conclusion

This Course of Study has served as the model for the Social Studies Course of Study currently in the implementation stage and the Mathematics Course of Study beginning this year. Due to the experience gained with the Science Course of Study, the three-year process to implementation has been narrowed to two years for the Social Studies and Mathematics Courses of Study and all of those to follow.

## References

- American Association for the Advancement of Science. (1993). *Benchmarks for science literacy: Project 2061*. New York: Oxford University Press.
- Joint Council of the State Board of Education and the Ohio Board of Regents. (2001). *Science academic content standards*. Available: <http://www.ode.state.oh.us/ca/ci/acs/acsscience.htm>
- Jones, T. & Richey, R. (2000). Rapid prototyping methodology in action: A developmental study. *Educational Technology Research and Development*, 48 (2), 63-80.
- Mid-Ohio Educational Service Center. (1999). *Science course of study survey*. Mansfield, OH: Mid-Ohio Educational Service Center.
- Mid-Ohio Educational Service Center. (2001). *Average grade 4 proficiency test results 1998-2000*. Mansfield, OH: Mid-Ohio Educational Service Center.
- Mid-Ohio Educational Service Center. (2001). *Average grade 6 proficiency test results 1998-2000*. Mansfield, OH: Mid-Ohio Educational Service Center.
- Mid-Ohio Educational Service Center. (2001). *Science and mathematics professional development needs assessment interview*. Mansfield, OH: Mid-Ohio Educational Service Center.
- Mid-Ohio Educational Service Center. (2001). *Science and mathematics professional development needs assessment survey*. Mansfield, OH: Mid-Ohio Educational Service Center.
- Muskingum Valley Educational Service Center. (1999). *Science proficiency teacher inventories*. Zanesville, OH: Muskingum Valley Educational Service Center.
- National Research Council. (1996). *National science education standards*. Washington, DC: National Academy Press.
- Ohio Department of Education. (1994). *Science: Ohio's model competency-based program*. Columbus, OH: State Board of Education.
- Ohio Department of Education Center for Curriculum and Assessment. (2001). *Regional meeting power points: Academic content standards general*. Available: <http://www.ode.state.oh.us/ca/ci/>
- Ohio Department of Education Center for Curriculum and Assessment. (2001). *Science academic content standards*. Available: <http://www.ode.state.oh.us/proficiency/PROFICIENCY/01tests/interpguides/4testinterspint01.pdf>
- Smith, P. & Ragan, T. (1999). *Instructional design: second edition*. Upper Saddle River, NJ: Prentice-Hall.

# Students' Experiences of the Implementation of an Interactive Learning System in their Eighth Grade Mathematics Classes: An Exploratory Study

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## Abstract

*During the last decade US K-12 schools have approximately tripled their spending on increasingly powerful computers, expanded network access, and novel computer applications. The number of questions being asked by educators, policymakers, and the general public about the extent to which students are using these educational technologies, for what purposes, and to what effects, has likewise increased. Exploring the human implementation process is thought to be one key to understanding how educational technologies find, purchase and evolve in local classroom environments. This naturalistic inquiry explored students' classroom experiences during the semester-long process of implementing an interactive learning system, Destination Math, in two eighth-grade math classes in a rural mid-Atlantic Junior-Senior High School. Data collection was based on field observations prior to and during the implementation process, semi-structured interviews and focus group interviews with students, and document analysis. Grounded theory methods were used to analyze the data. I found that students experienced high levels of learner-control when using the interactive learning system for math, given the variety of activity choices afforded by the instructional medium, the multiple pathways to representation of math concepts, and the opportunities for math-talk with their peers. For these three reasons, students reported increased interest in math in the Destination Math class, compared with the regular math class. Researcher observations supported students' self-reports: students' engagement with math, operationally defined as time-on-task, increased in the Destination Math class. These findings suggest that when educational technologies are used to heighten student-control over the learning environment, these instructional tools may increase students' interest in subject matter and their engagement in learning.*

## Introduction

Increasingly powerful computers, expanded network access, and novel computer applications have enlarged both investments in, and expectations for, the transformation of students' classroom learning experiences. During the last decade US K-12 schools have approximately tripled their spending on educational technologies (Quality Education Data [QED], 1999). Improving students' classroom learning experiences by exploiting the appeal of challenging interactive learning technologies is a powerful motivation for such significant investments in educational technologies. However, while investments in educational technologies have steadily increased, not enough money has been spent on educational research (Web Based Education Commission, 2000; Shaw, 2000). Merely because curriculum producers are making software and their school customers are acquiring their products and the hardware to allow them to be used, does not tell us how, or to what extent, the daily lives of typical school children are being affected or changed by these educational technologies (Becker, 1998, p. 20). The present research was designed to enliven and enlighten current discussion of student-use of educational technologies in classrooms, by exploring the implementation of an educational technology in two eighth grade math classes.

This research represents a departure from the early research on educational technologies (1970s and 1980s) which emphasized the learning outcomes value-added model: the decontextualized, cognitive-psych pedigree of researching individual students' interactions with computers. These early studies looked so specifically at particular technologies and their impact on single students, that they contributed little to the larger more challenging project of understanding the roles that technologies can play in addressing the key challenges of learning in classroom contexts. Recent research on educational technologies is characterized by an awareness that the impact of technology on specific aspects of teaching and learning can be "usefully understood only in context" (McMillan Culp, Hawkins, and Honey, 1999, p. 8). Educational technologies alone do not translate into improved instructional outcomes: they matter only when harnessed for particular ends in the social context of classrooms: they must therefore be studied in these contexts. The regular math class, and the DM class, represented the contexts for this naturalistic inquiry. Throughout this fourteen-week study, the focus of the research was on the students' experiences with the interactive learning system in their math class.

Research on classroom innovation has infrequently focused on students' experiences of changes in their classroom learning environments (Hammersley, 1999). While previous research has identified student attitude toward educational technologies as an important variable influencing their learning experiences (Francis & Evans, 1995; Liu, 1999; Christensen, 1997), these studies have not described students' experiences with these novel tools over time and in students' own words. Instead, students' reports of their classroom experiences with educational technologies have focused on the frequency of computer use in specific courses, the type of software utilized, and students' responses to an admittedly rough categorization of activities (Becker, 1994). The purpose of this study was to describe students' experiences with an interactive learning system during one school semester. The main research question asked: How do students experience a classroom innovation in the form of an interactive learning system in their math class, during the semester-long implementation process? This question was operationalized by asking the more informal question: What do students do, say and make in the research context over time?

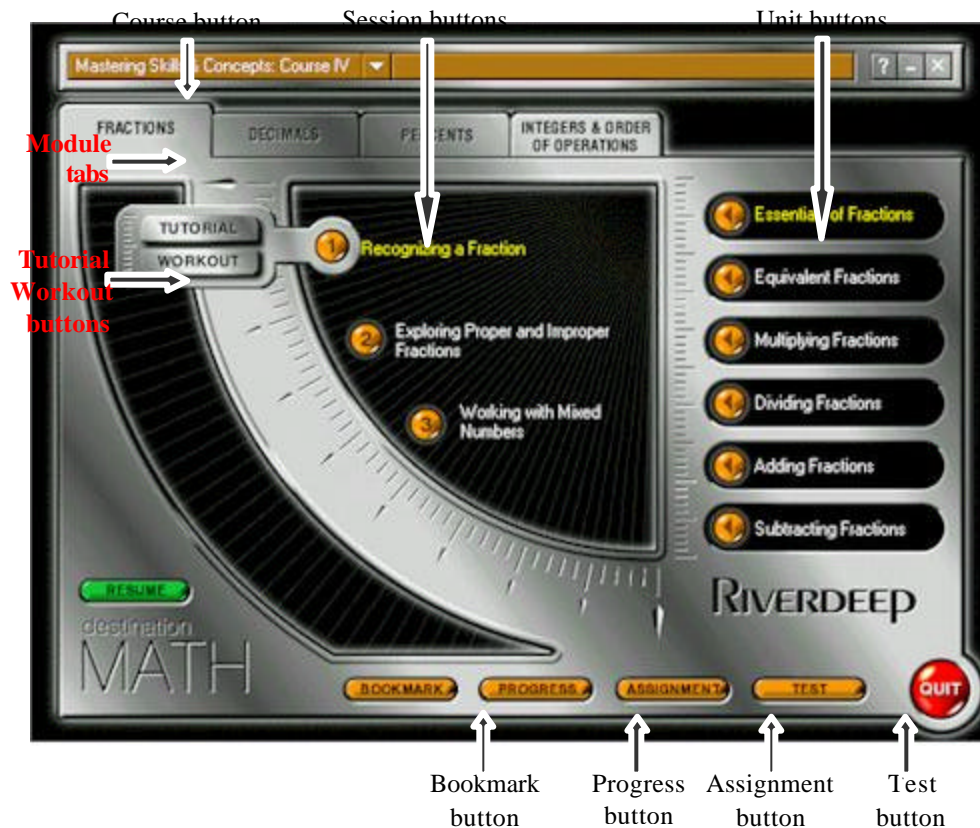
## **Research Context**

### **Participants**

Participants in this study included 32 students (14 and 18) in two lower-level eighth grade math classes. This research began in the regular math class four weeks prior to the implementation of the interactive learning system, and continued during the ten-week implementation process. Qualitative methods were used to explore the process of implementing the interactive learning system, DM, twice weekly, during students' regularly scheduled (40 minute) math period in the computer lab, on Wednesdays and on Thursdays. On alternate days, students and their teacher used the "highly structured" and "highly prescriptive" (Saxon, 2001) text-based math lessons, provided in the district-adopted math curriculum. In this study, the teacher used the Riverdeep (RVDP) Interactive Learning System to revise math concepts previously taught to students using the Saxon math lessons.

### **Materials**

RVDP was founded in Ireland in December 1995 as a developer and provider of technology-based educational solutions for the United States kindergarten through high school, or K-12 market. RVDP offers Internet and CD-ROM based comprehensive courseware and supplemental curricula in math, science, and language arts. *Figure 1. DM Main Menu Screen (Course IV)*



In November 2000, the Westridge school district purchased licenses for use of the Riverdeep interactive learning products by all eighth grade students and their teachers, intentionally targeting improvement of students' math skills. RVDP curriculum products for middle school math include *Destination Math* (DM), a comprehensive math program designed to supplement or replace traditional math curricula, and *Tangible Math*<sup>™</sup>, a simulation-based math program, which focuses on the development of students' problem solving and analytical skills. In the present study, the teacher chose to implement the DM component of the RVDP suite of learning resources with both her eighth grade math classes. DM comprises five math courses organized in two series or curricula for students in grades four to twelve. Participants in this study used DM Course IV Mastering Skills and Concepts.

Figure 1 presents the structure of DM Course IV, used by students in this study. The course is composed of four *modules*: Fractions, Decimals, Percents, and Integers and Order of Operations, each representing a major topic in the eighth grade math curriculum. Each DM module is further broken down into *units*, which address specific learning objectives and are correlated with state and national standards for mathematics learning. The teacher management system for DM contains a bank of test items that are correlated with specific learning objectives, and organized by unit. Unit buttons for the fractions module are visible to the right of the user's screen in Figure 1. DM units are further divided into three *sessions*. The user enters DM at the session level.

Each DM session comprises a *tutorial* and a *workout*. The user may also access a tutorial or workout as a system-generated *prescribed assignment*, based on the level of mastery of learning objectives demonstrated by the user on assigned tests. From the main menu, DM users may choose to work on a teacher-assigned test, a tutorial, or a workout. During their ten-week use of DM in their math classes at Westridge, students were instructed to complete teacher-assigned DM tests, prescribed assignments, and any additional activities for each unit, before proceeding to the next unit.

## Data Collection

Participant observation strategies (observation and conversation) enabled me to take an active role in experiencing and enquiring about (Wolcott, 1999) students' uses of DM in their math classes. In the initial weeks of this study, I focused my classroom observations by detailing elements of the classroom environment (classroom map

protocol), and describing the activities of students therein (activity framework protocol). I recorded students' actions and interactions within the DM math class using a small pocket recorder. Written descriptions of participants' coverbal behaviors (expressions, gestures, actions) in their math classes informed and extended students' voice-recorded data. Combined with classroom observations, unscheduled verbal exchanges with students provided valuable opportunities for me to become familiar with "the native communicative repertoire" of participants in the eighth grade math class (Briggs, 1984, p. 24). These classroom conversations provided crucial information on the interaction between the eighth grade students' use of language, and their social behavior, and also between students' social and cultural norms and patterns of interaction in the math class. Ongoing conversations with students informed the development of semi-structured interview guides throughout the data collection process.

I planned exploratory and culminating focus group interviews with students to further explore their experiences with educational technologies and math in general, and with DM in particular. Flick (1998) suggested four processes or elements of group discussions, which I used to structure the focus group interview guide: brief explanation of the research procedure, preparation for the discussion, discussion stimulus, and process discussion (p. 119-120). I held exploratory focus group interviews with students to probe their prior experiences with educational technologies at home and in school, their attitudes toward math, and their expectations for the DM learning system. Culminating focus group sessions in the final week of this research offered opportunities for respondent validation or member checking of my own interpretations of students' experiences with DM in their math class.

I used Patton's (1990) "general interview guide approach" (p. 280) to plan periodic semi-structured interviews with individual students. These interview guides were developed and sequenced using Spradley's (1979) ethnographic questions, the third element in his ethnographic interview (p. 58-68). I used naturalistic sampling (Ball, 1990) to select four students for semi-structured interviews "to generate the information upon which the emergent design and grounded theory can be based" (Lincoln and Guba, 1985, p. 201). Combined with classroom conversations and observations, these individual interviews enabled me to construct portraits (Lawrence-Lightfoot and Hoffman, 1997) or mini-embedded case studies of four students in the teacher's eighth grade math classes (two students from each class). Each individual student portrait served as a rhetorical device, providing vivid renditions of broadly observable patterns of class behavior, thereby directing and redirecting the most fruitful path of research in answering the research questions. These four richly detailed student portraits, grounded in conversation and interview data, facilitated "the on-going joint collection and analysis of data associated with the generation of theory" (Glaser and Strauss, 1967, p. 48).

To further extend my understanding of the research context, I analyzed text documents gathered from the research setting (Glesne and Peshkin, 1992) which included a printed copy of the school mission, the Saxon math texts, students' homework assignments, DM test reports, DM progress reports, and so forth.

## Data Analysis

Given the documented need for new, theoretically expressed understandings of students' and teachers' experiences of the classroom implementation of educational technologies, I chose to analyze my transcribed research data (classroom observations, classroom conversations, interviews) and related documents, using grounded theory methods. "The value of the methodology... lies in its ability not only to generate theory but also to ground that theory in data" (Strauss and Corbin, 1998, p. 8). I proceeded from description to conceptual ordering and theorizing (three activities foundational to Strauss and Corbin's theory building process), by iteratively coding transcribed data regarding students' activities in their math class. Strauss and Corbin (1990) explained that coding is "the process of analyzing data" (1990, p. 61), in order to create theory from data.

I developed a systematic three-step process for coding all transcribed data. To generate initial categories and to discover relationships between these categories, I began by coding transcribed exploratory interviews and classroom conversations by hand, using participants' own words (in vivo codes) when possible. I then record coded data electronically using the qualitative data analysis software, *N.5*. In parallel with my use of *N.5* to code transcribed data (line-by-line and open coding), I employed the concept-mapping software program, *Inspiration*, to explore relationships within and between concepts evident in the data (axial coding). The multiple representational methods for linking categories, which *Inspiration* afforded, supported development and refinement of my emerging grounded theory (selective and focused coding) of students' experiences with DM in their math class.

Flick (1998) noted that this combination of multiple methodological practices in a single study is best understood as "a strategy that adds rigor, breadth, complexity, richness, and depth to any inquiry" (p. 231). I employed these methods of data collection and analysis to secure an in-depth and richly-triangulated understanding of students' experiences with an interactive learning system in their math class. Maxwell's (1992) five kinds of

understanding and validity in qualitative research (descriptive, interpretive, theoretical, generalizability and evaluative) were used to guide all phases of data collection and data analysis.

## Results and Discussion

During the ten-week implementation of DM in their math class, students experienced a level of control over their own learning that they had not experienced in their regular math class using Saxon. Control is relative. Students spoke positively about the level of control afforded to them vis -à-vis math activities, representation of math content and the social context for these activities: the opportunity to interact with their peers, in the DM math class.

### Activity Choices

Students who completed their DM tests and prescribed assignments could choose math activities from a suite of DM tutorials (providing repetition of the problem explanation, partial or complete explanation of the problem, and additional practice problems), workouts (sets of complex problems), or progress feedback and reports. Students frequently contrasted the variety and choice of math activities in DM with the limited set of questions in their regular math textbook: “With DM the choices are more fun and there’s more of them than over here [regular math class].” Students enjoyed having opportunities to become informed and make choices about their math learning with DM: “Well instead of just, like, being told what to do, you get to think about what you’re gonna do. Like you can choose what you wanna do.” One student explained that the activity choices in DM enabled him to control what and how he learned math: “You can go with what you want to do, and what you think you’re capable of learning. I like that you can go at your own pace... You’re not held back by other people.” Researcher observations suggest that when using DM, students made instructional choices that supported their own math learning.

For example, as students gained in their understanding of the DM activity system, they used the activity options within DM tests, tutorials and workouts to increase their individual access to detailed explanations of math problems. Although students were not instructed by their teacher to use the DM *test feedback*, *test report*, and *progress report* activity options, they discovered and employed these tools to review, reflect upon, and regulate their own math learning with DM. Students who scored their DM math test used instantaneous test-feedback to compare their own answers to test questions with the correct DM responses provided. The correct-answer feedback provided in DM enabled students to identify the source of their errors by reviewing and reinterpreting both the test question and their own problem solving strategies. As one student explained:

...you just say, “Score test!” and then it tells you what you got, and you can go back, and see what the answer should have been and stuff. That kind of makes ya try and figure it out, like, why you didn’t get the right answer. It shows you the right answer. So you know how to do it.

The following example represents one-student’s verbal response to test-feedback provided on the first part of her test on integers:

Oh, why did I do that? Oh! I don’t know why I did that! This one was easy, from least to greatest. What did I put? [Locating her own response] What the heck! I put them from greatest to least! For [number] 38 [Pause] Oh, I didn’t divide! I never found the average. I was supposed to divide by 10! And I bet that’s what happened in the last one as well! Now this one is six, negative six. This is positive, this is negative. So how is it equal? [pause] Oh I didn’t times it when I got the number! [Pause] I really need to read the questions!

Students used DM test feedback information in this way, to interpret, analyze and improve their own math performance. Clariana (1990) found that students who received correct answers after one missed attempt outperformed students who were required to repeatedly answer questions until reaching the correct answer. Clariana noted that students who received correct answers after one missed attempt used the immediate feedback they received to clarify misunderstandings and use this information to solve successive problems. In the present study, students used immediate test feedback to begin to understand and effect positive changes in their own learning.

Students who completed and scored a teacher-assigned DM test also received a DM test report which provided information regarding the number of correct, incorrect and attempted problems, the students’ percentage score, and the student’s performance on individual learning objectives assessed within the test. Students learned to use the progress report data provided (e.g., percentage of problems correct for each activity, amount of time spent on each activity, and date the activity was completed) to identify gaps in their progress, plan make-up work and

navigate the activity options within DM. They frequently used these accessible and transparent reports of their DM work to critically appraise their own progress with the learning system.

Students' sophisticated use of feedback and report tools to effectively control their own learning in the DM class suggests that learners can develop the skill and will (McCombs & Marzano, 1990) to manage their own learning, given educational technologies which provide detailed, accessible, and instantaneous feedback to students regarding their learning.

### Multiple Representations of Math Concepts

Students also contrasted the multiple and dynamic methods for representation of concepts (audio, visual-graphics, visual-text), in the DM scenario-based math problems, with the static problem sets assigned in their regular math textbook. "The workbook pages are just black and white. It's hard to concentrate in the math class. DM is colorful, and it's more fun. It has cool graphics and pictures and things. You can just listen to the math on there." Students frequently noted the benefits of the multiple pathways to learning (speech, graphics, text) provided in each DM tutorial and workout explanation. They suggested that these three modes for representation of problems supported their interest and engagement in math during their completion of DM problem tasks.

Referring to the audio presentation of math concepts in DM, one student insisted, "It makes it [math] more interesting. And the voices, they say it in a fun way, not like in a serious way, or like a baby way." A peer added, "You understand things way better when you're hearing somebody say it than when you're just reading!" Students noted that the visual representation of math concepts in DM also increased their interest in the DM math activity: "If you have something that you see there that catches your eye, you actually want to do it [math activity]." Students liked the use of animated graphics to support scenario-problems in DM, and claimed that these graphic representations of math content supported their understanding of underlying math concepts:

They give you a lot of pictures and stuff that help. The one sheep thing, like when he was cutting the wool off the sheep to make the things, they had the little sheep in the little circle. Then they colored the circle that had the cut sheep, and they showed you the fractions for how many cut sheep there were to the whole bunch. So, that's a picture that I found helpful to use. Besides trying to figure it out in your head, you have it right there on the computer screen. You can just count it, one by one.

Students noted that in addition to the audio and visual representation of math concepts provided in tutorials and workouts, the step-by-step text based explanations of math concepts in DM also supported their engagement in the math activity. One student explained, "They write out the problem for ya in steps. So its easy to follow."

Students suggested that these three formats (speech, graphics, text) for representation of math concepts in DM motivated them to attempt math problems, and sustained their interest in completing difficult word problems:

I find it hard to do the story problems. I think I got a lot better at 'em in the lab...  
Because before when I'd do 'em out of the book, I just [pause] I can do 'em, I just keep, well, I have to read that little paragraph thing there and I always get lost.

In their research comparing the performance of sixth grade students using single-representation (SR) and multiple-representation (MR) versions of a computer-based multimedia program for addition and subtraction of signed numbers, Moreno and Mayer (1999) also found that that the benefits of using MRs with students were strongest on difficult problems. Students in the present study claimed that the multiple formats (audio, visual-graphics, visual-text) for representation of math concepts in DM supported their engagement with difficult math problems, by allowing students to choose how they wanted to engage with the math problem.

Given these three formats for representation of math concepts in DM, *control* over the instructional event (the math activity) remained a critical factor motivating students' interest in math when using the interactive learning system to complete math problems. One student explained, "You can decide if you want to listen to the problem, or look at it... so you can't get lost. It [choice of representational formats] makes it [math] more interesting." This research suggests that multiple pathways to learning which support diverse learning preferences among students may positively affect their interest in subject matter. Hannafin and Sullivan (1995) found that students using either *text-plus-static graphics* or *text-plus-animated graphics* methods for presentation of math topics expressed a more positive attitude toward math than those who viewed the text-only version. In this study, the flexibility of the educational technology in facilitating multiple representations of information enabled students to learn in ways that supported their own pedagogical preferences. Consequently, students found math more interesting when learning with the DM interactive learning system which presented math problems through more than one modality, than when using the math text in their regular eighth-grade math class.



## Opportunities for Peer Discussion

In the regular math class using the Saxon scheme, students would quietly complete their practice set following the teacher’s correction of homework and presentation of the new increment. The teacher neither provided guidelines regarding whether or not students could interact with one another during the DM math class in the computer lab, nor organized formal groups or pairs of collaborators. Students spontaneously devised strategies to extend their experience with DM beyond their individual interactions with the interactive learning system to their peers in the math class. For example, many students made exhaustive efforts to synchronize their use of DM tutorials, workouts and tests with those students seated on either side of them. Students who coordinated their pacing of DM activities in this way consistently demonstrated high levels of interest and enjoyment in the math activity which often proceeded in game-like manner with frequent choruses: “Ready, Set, Go!” “One, two three!” “Marks, set, go!” Students in Mrs. Hall’s classes enjoyed learning math with their peers. Many students indicated that the quality of the math experience improved significantly when they had opportunities to work with one-another, and make instructional decisions. One student explained:

It’s a different environment thing. You know you’re just sitting around doing things, and you find out something new and neat that you just got to show some one, you know, like the people around you. Or if you’re getting frustrated with something, the other people are there to like, talk to you about it.

Students rarely sought assistance with DM math problems from their teacher, relying instead on their peers for math conversation and argumentation. Students’ discussions of math while using DM progressed through a sequence of stages that included advice-seeking, advice-giving, evaluation, comparison, clarification, acceptance or rejection of alternative rationales and defense of math claims or assertions. Table 1 presents examples of student math talk at each of these stages:

*Table 1. Components of Students’ Math-Talk when using DM<sup>a</sup>*

<b>Activity</b>	<b>Examples</b>
Request help	“Which one do I click on, here?” (seek advice) “Oh man! What’s this about, anyway? (seek help interpreting) “What’s an absolute value, again?” (seek definition)
Provide assistance or advice	“Click that one, man!” (provide answer without justification) “Because that’s relationship.” (provide partial explanation) “Because it’s the difference from Jack’s home to the school. Do you see that there?” (provide explanation) “Because it’s five over two.” (provide example of math concept)
Evaluate or compare options	“That looks wrong.” (assess) “This one is better.” (compare) “Yeah, I had that one figured out, too.” (compare, contrast)
Seek clarification	“How do you know it’s that one?” (seek justification) “You did what, again?” (seek reiteration of suggestion) “So why did you do that, there?” (seek justification)
Accept option	“That’s true.” (agree) “Cool!” (accept without indicating motive) “Yeah! That’s what I was thinkin’ – divide and then simplify. I got that too!” (accept as confirmation)
Reject option	“No it’s not! That’s a proper fraction there, JM!” (contradict) “No. Eight’s the denominator here.” (explain) “See, smartie! I told you it was this one, not a whole number!” (self-applaud)
Defend choice	“Oh, no it aint! That’s the opposite of an improper fraction, there, GS!” (reject, justify) “It has to be this one – I know those are all wrong!” (justify by elimination) “If you add them up you’ll get four sixths, and that has to be two thirds in lowest terms.” (recall mathematical proof)

*Note.* <sup>a</sup>Excerpted text from students’ classroom conversations

The informal nature of students' math-talk (frequently punctuated with vociferous argumentation, lavish expression and theatrical gesture) during their use of DM belied the depth of students' discussion of math concepts. Through the production of argument and counter-argument, students frequently attempted to persuade their peers that certain choices or decisions were preferable to concurrent choices or decisions in resolving DM math problems. Students demanded support and justification for mathematical assertions and claims presented by their peers: these demands were met using mathematical data, facts and evidence.

While this research supports the claim that novel educational technologies can trigger a restructuring of classroom experience, one which extends and elaborates the possibilities for student interaction (Kerr, 1996), it also shows that the social situation for students' use of educational technologies, can be a powerful determinant of their verbal behavior in these learning environments.

### Increased Interest and Engagement in Math

For the three reasons discussed (activity choices, multiple representations of math content, and opportunities for peer collaboration) students claimed that using DM increased their interest in, and engagement and productivity with, math: "The choices are just more fun, and there's more of them, and it's more interesting to see an' hear the math. You're just busy all the time." One student explained, "With DM you actually want to do the math, then. And it means you actually want to work harder and, like, get it done, and see how much you can cover and stuff." Another student contrasted his poor work ethic in the regular math class, with his sense of efficacy when learning with DM: "Well here I could actually get my work done. I could actually do my work in here. Over there I would do nothin' cause I'm lazy and it's boring. Here it's a lot better... DM helps. It gets you to like it a little more, so you actually get to do stuff. You want to do work: you don't just sit there."

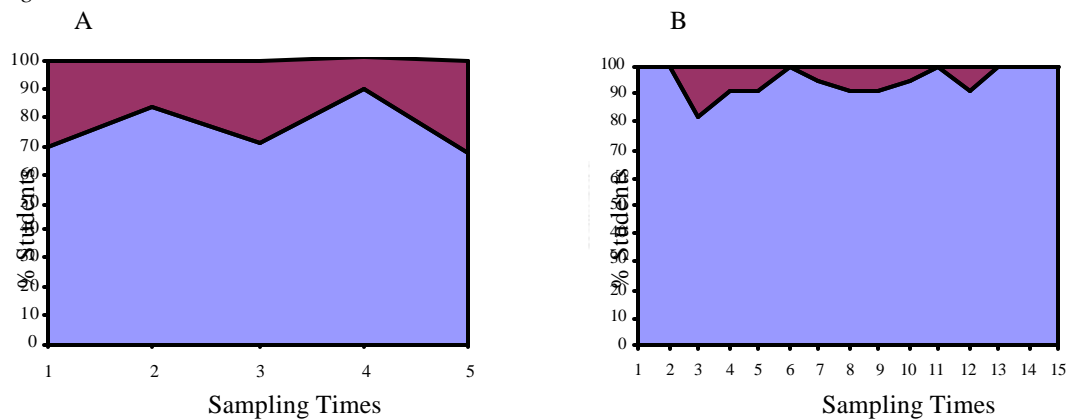
My observations of students' math discussions and activities with DM supported their self-reports of increased engagement with math in the DM class. During their first visits to the computer lab to use DM, I noted that students accessed the system with little delay, engaged in math-talk with one another, completed prescribed assignments, and frequently remained in the computer lab beyond the five-minute bell which signaled the end of math work in the regular math class. To document students' level of engagement with math when using DM, I routinely described the activities of a random sample of approximately one third of the students in each of the eighth grade math classes approximately ten minutes into each class session with DM, occasionally repeating the activity with a new sample of students ten minutes before the end of each session. Table 2 summarizes the activities demonstrated by students while using DM in the computer lab, classified as time-on-task and time-off-task, based on 21 recorded observations (one for each student sample) taken in 15 DM math classes

*Table 2. Description of Time-on-Task Categories*

<b>Time-on-Task</b>	<b>Time-off-Task</b>
<u>Student engaged in math talk:</u> Student discusses math with peer or teacher Student reads or thinks-aloud math	<u>Student talk is not about math:</u> Student asks peer for gum or candy
<u>Student engaged in math activity:</u> Student performs calculations using calculator or paper Student proceeds from one screen to another without visible distraction	<u>Student activity is not about math:</u> Student reads book of English poetry
	<u>Student is disengaged from math activity:</u> Student randomly clicks buttons on screen without obvious purpose or progression Student closes DM program and logs off computer before the 5 minute bell
	<u>Student faults hardware for time-off-task:</u> Student restarts computer Student changes monitor settings Student handles power chords

To further explore students' claims of high levels of engagement with math in the DM class, I used the categories represented in Table 2 to classify the behavior of each student within each observation sample as either on-task or off-task. Figure 2 presents a graphical representation of this time-on-task data, which was taken for students in both their regular math class, during the four-weeks prior to the implementation of DM (Figure 2 A), and in the DM math class during the ten-week implementation process (Figure 2 B):

Figure 2. Students' Time-on-Task in the Math Class



In contrast with Figure 2 A which represents descriptions of students' time-on-task in the regular math class, Figure 2 B shows that an average of 95% of students were found to be on-task with math, when using DM. From the first until the final log, there is very little variation in students' time spent on-task, while using DM. Students' engagement with math in the DM class, defined operationally here as time-on-task, began and remained high throughout this ten-week implementation of the interactive learning system for math. This analysis supports students' claims that they were more interested in math, and more engaged in math activities when using DM, compared with their regular math class, using the Saxon math scheme.

### Conclusions and Recommendations

Existing research advocates the use of educational technologies in classrooms to increase students' interest in specific subject matter (Webster, 1990; Yusuf, 1995). The present study supports this claim, and proposes that the level of learner-control afforded to students by an educational technology is positively related to students' level of interest in, and engagement with, the subject matter. Researcher observations of students' use of the interactive learning system in their math class, combined with individual and focus group interviews with students, suggest that the activity choices, multiple representation formats for learning, and opportunities for peer discussion of math concepts which students experienced when they used DM to learn math, increased students' interest in math, and resulted in high levels of engagement with math. Students experienced high levels of control over the instructional enterprise, when using the interactive learning system.

While learner control has generally been used to refer to the delegation of instructional decisions to learners regarding the sequence and pacing of instructional activities and the identification of learning needs (Johnson and Johnson, 1996), this research suggests that learners' decisions regarding the social context for their learning are also critical to our understanding of how learner-control evolves during the classroom implementation of educational technologies. Further exploration of students' math talk while using educational technologies for classroom learning would inform our understanding of how students support one another in developing learner-control strategies during the initial implementation of educational technologies in their classes. This research would enable us to identify strategies that students adopt or co-create to control their own learning using linear and open-ended learning systems in classrooms.

This research suggests that in classroom environments which afford opportunities for students to display what they know and what they can do when using motivational educational technologies, students' classroom conversations, or math-talk may provide compelling evidence of their understanding of math concepts. Implications for classroom practice include providing opportunities for students to engage in sense-making practices with their peers as they work to understand mathematical concepts. As educators, we are called to redress our unfamiliarity

with children's ways with words (Heath 1983) - their ways of organizing their experience and expressing meaning, and examine how technology enhanced learning environments may provide a catalyst for exploring evidence of understanding in students' classroom conversations.

This study shows that by increasing students' opportunities exert their own instructional preferences in learning required course content, educational technologies may positively influence students' interest in, and engagement with, subject matter. In light of the tangible benefits for students, this research challenges us to further explore the evolution of learner-control in technology-enhanced learning environments, and thus re-examine the role of the learner in instructional contexts.

## References

- Ball, S. J. (1990). Self-doubt and soft data: Social and technical trajectories in ethnographic fieldwork. Qualitative Studies in Education, 3, 157-171.
- Becker, H. J. (1994). Analysis and trends of school use of new information technologies (Report prepared for the U.S. Congress Office of Technology Assessment, Contract No. K3-0666.0). Irvine, CA: University of California.
- Becker, H. J. (1998). Running to catch a moving train: School and information technologies. Theory into Practice, 37, 20-30.
- Briggs, C. L. (1984). Learning how to ask: Native metacommunicative competence and the incompetence of fieldworkers. Language in Society, 13, 1-28.
- Christensen, R. R. (1997). Effect of technology integration education on the attitudes of teachers and their students. Dissertation Abstracts International, 58(11), 4242A. (Publication No. AAT 98-16134).
- Clariana, R. B. (1990). A comparison of answer until correct feedback and knowledge of correct response feedback under two conditions of contextualization. Journal of Computer-Based Instruction, 17, 125-129.
- Flick, U. (1998). An introduction to qualitative research. Thousand Oaks, CA: Sage Publications.
- Francis, L. J., & Evans, T. E. (1995). The reliability and validity of the Bath County computer attitude scale. Journal of Educational Computing Research, 12, 135-146.
- Glaser, B. G., & Strauss, A. L. (1967). The discovery of grounded theory. Chicago, IL: Aldine.
- Glesne, C., & Peshkin, A. (1992). Becoming qualitative researchers. White Plains, NY: Longman.
- Hammersley, M. (1999). Introduction. In M. Hammersley (Ed.), Researching school experience: Ethnographic studies of teaching and learning (pp. 1-14). London, UK: Falmer Press.
- Hannafin, R., & Sullivan, H. (1995). Learner control in full and lean CAI programs. Educational Technology Research and Development, 43, 19-30.
- Heath, S.B. (1983). Ways with words. New York: Cambridge University Press.
- Johnson, D. & Johnson R. (1996). Cooperation and the use of technology. In D. H. Jonassen (Ed.), Handbook of research for educational communications and technology (pp. 1017-1044). New York, NY: Macmillan.
- Kerr, S. T. (1996). Visions of sugarplums: The future of technology, education and the schools. In S. T. Kerr (Ed.), Technology and the future of schooling (pp. 1-27). Chicago, IL: University of Chicago Press.
- Lawrence-Lightfoot, S., & Hoffmann Davis, J. (1997). The art of science and portraiture. San Francisco, CA: Jossey-Bass.
- Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic inquiry. Newbury Park, CA: Sage Publications.
- Liu, L. (1999). The influence of different teaching methods on student attitudes toward technology. Paper presented at the annual meeting of the Society for Information Technology and Teacher Education (SITE), San Antonio, TX.
- Maxwell, J. A. (1992). Understanding and validity in qualitative research. Harvard Educational Review, 62, 279-300.
- McCombs, B. L. & Marzano, R. J. (1990). Putting the self in self-regulated learning: The self as agent in integrating skill and will. Educational Psychologist, 25, 51-70.
- McMillan Culp, K., Hawkins, J., & Honey, M. (1999). Review paper on educational technology research and development. New York, NY: Center for Children and Technology, Education Development Center. Retrieved May 19, 2001, from the World Wide Web: [http://www2.edc.org/CCT/cctweb/public/include/pdf/01\\_1999.pdf](http://www2.edc.org/CCT/cctweb/public/include/pdf/01_1999.pdf)
- Moreno, R., & Mayer, R. E. (1999). Multimedia-supported metaphors for meaning making in mathematics. Cognition and Instruction, 17, 215-248.
- Patton, M. Q. (1990). Qualitative evaluation and research methods. Newbury Park, CA: Sage Publications.

Quality Education Data (QED). (1999-2000). Quality education data's technology purchasing forecast (5<sup>th</sup> ed.). Denver, CO: QED.

Saxon, J. (2001). What's different about Saxon? Saxon Publishers. Retrieved May 14, 2001, from the World Wide Web:

Shaw, D. (2000, September 8). K-12 education: Acting on ignorance. Web-based Education Commission Report. Retrieved May 21, 2001, from the World Wide Web: [http://www.hpcnet.org/cgi-bin/global/a\\_bus\\_card.cgi?SiteID=179532](http://www.hpcnet.org/cgi-bin/global/a_bus_card.cgi?SiteID=179532).

Spradley, J. P. (1979). The ethnographic interview. Fort Worth, TX: Harcourt Brace Jovanovich College Publishers.

Strauss, A., & Corbin, J. (1990). Basics of qualitative research: Grounded theory procedures and techniques. Newbury Park, CA: Sage Publications.

Strauss, A., & Corbin, J. (1998). Basics of qualitative research: Techniques and procedures for developing grounded theory. Thousand Oaks, CA: Sage Publications.

Web-based Education Commission (2000). The power of the Internet for learning: Moving from promise to practice. Report of the Web-based Education Commission to the President and the Congress of the United States, December, 2000.

Webster, A. H. (1990). The relationship of computer-assisted instruction to mathematics achievement, students' cognitive styles, and student and teacher attitudes (fifth grade). Dissertation Abstracts International, 51(10), 3331A. (Publication No. AAT 91-03410).

Wolcott, H. F. (1999). Ethnography: A way of seeing. Walnut Creek, CA: Altamira Press.

Yusuf, M. M. (1995). The effects of logo-based instruction. Journal of Educational Computing Research, 12, 335-362.

# School Library Media Specialists and Fair Use: The Ultimate Gray Area?

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## Introduction

As library media specialists, we often find that we are considered, along with our administrators, the school experts in copyright law. Questions we may ask ourselves, given such issues, include: (1) Am I liable if people in my school violate copyright law with library media center (LMC) materials and/or equipment? (2) How can I stop illegal copying of computer software in my school? (3) Are schools exempt from fair use guidelines when using print and non-print media for instructional purposes? (4) How can I encourage teachers to comply with copyright law? And, (5) is copyright law really a “gray area?” These questions and more will be addressed in this article. We will look first at copyright law and fair use, as well as the educational multimedia guidelines – two areas which support some copying without obtaining author or owner permission.

## What is Fair Use?

Section 107 of the 1976 Copyright Act covers “Fair Use,” a legal principle supporting some limitations to copyright holders’ exclusive rights. Therefore, Fair Use is law. What this means for us in the school library media center, is that we, our faculty, staff, and students may use portions of copyrighted materials depending on:

- (1) purpose and character of use;
- (2) nature of the work;
- (3) portion being copied; and
- (4) marketability of the work.<sup>1</sup>

Fair use factor #1, the purpose and character of use, covers how the user wishes to use the copied materials. Copying of a nonprofit, educational, or personal nature, tilts in favor of fair use. Copying of a commercial nature tilts in favor of the copyright owner. This means, in some instances, that an educator may make multiple copies of certain works for teaching purposes but may not sell these copies. This fair use factor also supports quotations integrated into a paper or project, whether in print or electronic format.

Fair use factor #2, nature of the work, examines characteristics of the work under consideration for copying. It considers whether the work is fact or fiction, published or unpublished. Nonfiction, published, print works are most likely to be considered fair use, given this factor. This means that a factual article on the history of instructional technology (IT), published in a professional IT journal, is more likely to be copy-able than is an unpublished story written by a leader in the field.

Fair use factor #3, portion being copied, considers how much of the work the user wishes to copy. Given this factor, the smaller the amount used, the better. However, the law does not provide exact amounts. Instead, fair use factor #3 is evaluated two ways: quantitatively and qualitatively. Quantity, the more easily measurable piece, considers the amount copied relative to the whole as well as the amount needed to achieve the copying objective. Qualitative measurement is much more creative. This measurement is concerned with the concept of substantiality, whereby the copying of the heart of the work—no matter how small—is too much. An example of this might be a two-hour long video, from a particular school library media center (SLMC), whose whole story-line culminates with a minute-long clip on the most challenged item to remain on the shelf in that SLMC. Although the culmination point is very short, if that is the heart of the video, then that particular clip is too much to copy.

Fair use factor #4, marketability of the work, involves the effect that copying part or all of a particular work will have on the commercial marketplace. This factor focuses on economics. For example, if the copying of the work will affect how much money the copyright owner can earn off sales of that item, then any copying may be too much. In terms of this fair use factor, the person copying needs to ask the question: Is my copying this item going to hurt its’ marketability?<sup>2,3, 4</sup>

While users and owners/creators of works may differ widely in their interpretations of the fair use factors and the applicability of these factors to various circumstances, the more common interpretations of the four factors are those discussed above. It is important to remember that all four of these factors should in place for any copying to be considered legal under copyright law. Next, we address the educational multimedia guidelines.

## Educational Multimedia Guidelines

The Educational Multimedia Guidelines are **not** law and are much more restrictive than the fair use factors covered above. However, these guidelines are supported by many user groups and organizations representing owners, because the guidelines, if properly followed, do not normally violate copyright law. Accordingly, the user may borrow (the smaller amount the better):

Motion Media: 10% or 3 minutes

Text: 10% or 1000 words

Music/Lyrics/Music Video: 10% or 30 seconds

Illustrations/Photos: 5 by an individual artist/photographer; from a published collected work: 10% or 15 images

Numerical Data Sets: 10% or 2500 fields/cells 5

These guidelines are for multimedia projects only and are **more** restrictive than copyright law. However, many users apply these guidelines to all types of media under the assumption, since they are so restrictive, that they will then not be liable for any copyright violations. This is often true, but does not have to be so. What individual owners or creators may want for the use or copies of their works varies greatly. 6

### **Am I liable if faculty in my school violate copyright law with library media center (LMC) materials and/or equipment?**

This question relates to school library media specialist (SLMS) liability. Answer: copyright law follows the “chain of command.” Thus, the SLMS might find him/herself included in the list of those in violation, even if s/he had no knowledge of the violation, IF s/he had provided the equipment or materials used in the illegal copying. The school administrator could also be held liable, as another step in the chain. 7

### **How can I stop illegal copying of computer software in my school?**

Physically, you may not be able to. However, you can make such copying harder to achieve, by keeping all archival software copies under lock and key, keeping a record of all software licenses in an obvious place, teaching and informing your users of fair use and other copyright law applications, and placing notices that illegal use of the equipment for copying may result in fines or imprisonment on all equipment that can be used to copy. 8

### **Are schools exempt from fair use guidelines when using print and non-print media for instructional purposes?**

A quick and dirty answer: no! However, many owners, publishers, and others who represent those who own or create copyright works have criteria which may make some copying for educational purposes OK. Each work must be viewed individually to see if it would be in violation or not. 9

### **How can I encourage teachers to comply with copyright law?**

While there is no one answer to this question, there are many things which can make copyright compliance more obvious to faculty. Such items include: by example (The SLMS demonstrates proper copyright compliance.); providing current copyright information; keeping all archival software copies under lock and key; keeping a record of all software licenses in an obvious place; faculty in-services, i.e., teaching and informing your faculty of fair use and other copyright law applications; and placing notices that illegal use of the equipment or materials for copying may result in fines or imprisonment. 10 In addition, the SLMS may work alone or in tandem with other teachers to teach copyright compliance to students. Thus eventually, students may observe and also encourage teachers to be copyright compliant.

### **Conclusion: The Ultimate Gray Area**

Copyright issues are often considered the “ultimate gray area,” because there may be more than one answer to any one question, depending on who is asking, what the medium under question is, who owns that medium, and why copying or use of it is important. However, the bottom line is: it’s illegal to violate copyright law – anytime,

anywhere, for any reason. Thus, if a user is sure that s/he wants to use or copy a work, and such use/copying falls outside the fair use guidelines, it is important to make sure permission has been obtained from the owner/creator of the work or....don't copy.

## References

1. John Shelton Lawrence and Bernard Timberg, *Fair Use and Free Inquiry: Copyright Law and the New Media*. 2d ed. (Norwood, NJ: Ablex Publishing, 1989), 379-387.
2. Janis Bruwelheide, *The Copyright Primer for Librarians and Educators*, 2d ed. (Chicago: American Library Association, 1995), 11-13.
3. Rebecca P. Butler, "School library media specialists and copyright law: Do's and don'ts" (presentation at Illinois School Library Media Association Annual Conference, Decatur, Ill., 29 October 1999).
4. Rebecca P. Butler, "Social responsibility: Copyright as a social responsibility – Fair use: I need it now!" In *Knowledge Quest*, Vol. 29, No. 3: 35-36.
5. Fair Use Guidelines <http://www.libraries.psu.edu/mtss/fairuse/guidelinedoc.html>
6. Rebecca P. Butler, "Social responsibilities and intellectual property: Librarians and copyright" (workshop at Heritage Trail Library System, Shorewood, Ill., 20 September 2001).
7. Ibid.
8. Ibid.
9. Ibid.
10. Rebecca P. Butler, "School media specialists and fair use: The Ultimate gray area?" (presentation at AECT, Atlanta, GA, 9 November 2001).



# The Design of *Alien Rescue*, Problem-Based Learning Software for Middle School Science

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## Abstract

*The growing interest in the field of educational technology in the design of constructivist learning environments has led to a renewed examination of problem-based learning (PBL), an approach to instruction in which all learning results from students' efforts to solve a complex problem. Concurrent advances in technology make it possible to use this approach with a wider range of audiences than have traditionally used PBL, yet few guidelines exist for designers interested in creating computer-based PBL environments. This paper presents some of the lessons learned from the process of developing Alien Rescue, winner of the 2001 Learning Software Design Competition sponsored by the University of Minnesota.*

## Alien Rescue

*Alien Rescue* is a computer-based PBL program for use in sixth grade science classes. The primary learning objectives of *Alien Rescue* focus on the solar system and the scientific instruments used to investigate it, though the program offers ties to other areas of the curriculum, including writing and mathematics.

The science fiction premise of *Alien Rescue* takes students to a newly operational international space station where they become a part of a worldwide effort to rescue alien life forms. The program begins with the 7-minute long Opening Scenario, which presents the central problem of the program, and which students, acting as scientists, are asked to participate in solving. A spaceship carrying six species of aliens fleeing their own planetary system have arrived in Earth orbit. Their ship was damaged during their voyage, and except for their engines and computer databases, little of their technology continues to function. In order to survive, they must find new homes on worlds that can support their life forms. Having picked up Earth broadcasts, the aliens learned our languages with the intention of asking for our help to relocate to worlds in our solar system. However, when their life support failed completely, the aliens could only complete a distress message to be sent once they reached Earth orbit, then entered a state of suspended animation, where they must remain until they are safely relocated to suitable worlds.

Students are informed that they are just one of many teams of scientists participating in this rescue operation, and that their task is to determine the most suitable relocation site for each alien species. In order to solve this problem, students must engage in a variety of activities. They must learn about the aliens and identify the basic needs of each species. To do so, students search the Alien Computer, which they are informed was moved from the alien ship to the international space station so that they could conduct their research. They must then investigate the planets and moons of our solar system, searching them for possible matches with the needs of the aliens. Students gather this information in two ways. They can search the Solar System Database, a resource within the program containing information about the sun, nine planets, and ten of the large moons of our solar system. Then, to gather needed information that is missing from the Solar System Database, students can use a simulation within the program that allows them to design and launch probes to other worlds. Students interpret the data returned from these probes, applying the information they glean back to the problem. Finally, students must use the information they gather to select a new homeworld for each species and justify their decisions. They identify their choices and write a rationale for each choice in the Recommendation Form. To discourage students from developing a solution without time for adequate investigation, the Recommendation Form does not appear on screen until students have used the program for 300 minutes.

To support students as they work toward developing a solution, *Alien Rescue* offers the Expert Tool. This tool provides video of a character who is scientist working on the same problem as the students as he interacts with the resources within the program. The expert models his process as he works on finding a home for one of the species. He does not help students with the other species, nor does he direct them to work in a particular way. However, by making explicit the strategies an expert brings to bear as he works on the problem, the Expert Tool supports students in developing effective problem-solving strategies.

*Alien Rescue* is an example of a student-centered learning environment. Students are engaged in a complex task, but they determine and control their process. Yet they are not expected to determine this process or develop a

solution on their own. *Alien Rescue* was designed to be used in classrooms rather than as a product for home use, and we consider the social negotiation that occurs as students interact with their teacher and peers to be an essential source of support for learning through this program. The teacher, working as a facilitator, pushes students to articulate their planning and reasoning, challenges their misconceptions, promotes peer collaboration, and builds connections to a wide range of scientific topics. Peers provide support for the complexities of the environment and help each other to refine their understandings as they discuss/argue the merits of alternative solution plans.

### **Problem-Based Learning**

PBL is an instructional approach in which learning occurs as a result of students' efforts to develop a solution to a complex problem. Instruction begins with the presentation of a problem situation. Students work in teams to identify problem constraints, form hypotheses, collect and analyze data, and develop a solution plan. Along the way, students discover that they need a great deal of factual information in order to understand the problem, determine all their options, and develop a viable solution. In order to collect it, they use the same tools experts would use: existing informational resources such as books and computer databases, and domain specific tools such as microscopes, calculators, or maps.

The literature on PBL has suggested a number of benefits for this approach, including high levels of intrinsic motivation (Albanese & Mitchell, 1993; Stepien, Gallagher, & Workman, 1993), enhanced problem-solving skills (Gallagher, Stepien, & Rosenthal, 1992; Williams, 1993), and more effective self-directed learning (Aspy, Aspy, & Quinby, 1993; Blumberg & Michael, 1992). Despite the potential for learning that PBL offers, the realization of these benefits is far from assured. The success of PBL depends on students' "willing cognition," their intrinsically motivated efforts to gather the information and develop the skills they need in order to create well-reasoned solutions. Without this investment of cognitive effort, students may fail to recognize the relevant nuances of the problem, neglect to identify pertinent learning needs, or rush to develop solutions that turn out to be non-viable. Establishing and maintaining this willing cognition in students must therefore be an overarching goal for designers of PBL programs.

### **Guidelines for the Design of PBL Programs**

While the design of *Alien Rescue* was informed by both theory and research, a number of additional insights arose through the process of development and testing. In the remainder of this paper we share some of these insights in the belief that they can help to guide the design of future computer-based PBL environments. The following suggestions address issues related to the design of the central problem of a PBL program, the informational resources provided, the program interface, and the support materials for classroom teachers.

*Develop an interesting and rich problem that creates a need for information and multiple applications of key strategies.* The most important design task in the development of a PBL program is the creation of the central problem. This problem will affect students' willingness to take ownership over their process and learning. It will also determine what learning needs students identify and, as Stepien, Gallagher, and Workman (1993) point out, what information they must "run into" in order to solve the problem. To promote students' "willing cognition" and maximize the potential for learning, the central problem of a PBL program should have five characteristics. First, it should be *interesting* to the target audience in order to promote students' ownership over their process and solution. For example, in our early planning phase for *Alien Rescue*, we initially considered having students identify a world for human colonization. We eventually decided that students would find aliens more interesting and would therefore be more intrinsically motivated to invest cognitively in solving the problem.

Second, the problem needs to be *challenging*, so that a solution does not seem obvious. Students are accustomed to well-structured problems where all necessary information is presented in the problem itself, the problem has a single correct solution, and the time to solution is relatively brief. If students perceive that the problem is not challenging, they may fail to recognize the need for additional knowledge and "solve" the problem without fully understanding it. Once students believe that they have completed their work, they may be reluctant to invest further cognitive effort in developing a solution.

Third, the problem needs to be *manageable* so that students persist in their efforts to develop a solution. As students recognize the complexity of the problem, they may become frustrated if they believe that it is too difficult or that they cannot learn all they need to know in order to develop a solution. Balancing challenge with manageability and effectively communicating both to students can be quite difficult. In our testing with *Alien Rescue*, we have found that students generally recognize the challenge relatively quickly, but take some time to

recognize its manageability. With six species of aliens, each with a different set of needs, and nineteen worlds to consider as possible homes for them, the problem requires students to conduct a great deal of research, a fact which they recognize as they come to understand the problem. Early in the program we have seen some students express some apprehension and frustration as they experience uncertainty about what they should do and are unable to solve the problem quickly. This typically evaporates as students come to understand the resources within the program and begin to develop a process to work toward solution. What gets students over this hurdle and keeps them cognitively engaged is their interest in the problem and in the virtual environment in which the problem is set. In this way, the rich media and interesting tools provided within the program may serve to motivate students to persist long enough to recognize that they can manage the challenge the problem presents.

Fourth, the central problem of the PBL program should *cause students to recognize the need for information and skills*. When students recognize that they do not have all of the information they need, they seek it, and it is this effort to meet these learning needs that drives students' investigation and which results in their natural acquisition of key terminology, factual information, and concepts within the problem domain. Because students have determined the need for certain knowledge and have identified a method for acquiring that knowledge, all their learning is meaningful to them. It is therefore essential that the problem lead learners to recognize that they do not have all of the information they need to develop a solution.

Finally, the problem should *create multiple opportunities for students to apply the same problem-solving strategies* in order to encourage students to reflect on and refine them. In *Alien Rescue*, students must select homes for five species of aliens (the expert recommends a solution for the sixth). While the needs of each species are different and the conditions on each world vary, the process for developing a solution for each species is basically the same. Students must consider different factors and constraints, but they can apply the same problem-solving strategies. This gives students an opportunity to refine their process and reflect on what is effective.

*Design miniature problems into the environment.* PBL provides not only a problem but also a context in which that problem takes place. While it is impossible for designers to control all aspects of the PBL experience, it is possible to design small complexities into that context that learners must encounter in order to solve the problem. The need to cope with constraints, determine alternative resources for data collection, and interpret data provides challenges that encourage deep thinking and an ongoing need for the development of problem-solving strategies. This helps a PBL environment to reflect real world problem solving, where overcoming numerous hurdles is a common necessity. These miniature problems also provide opportunities for rich discussions on science.

One example of a miniature problem built into *Alien Rescue* occurs in the alien computer. Rather than using the names of elements to communicate the composition of their atmospheres, the aliens show spectrograms. Spectrograms show the spectral signature of an element; the spectrogram of each element is unique and universal. The aliens communicate this information using spectrograms ostensibly because they were unable to learn the English translation for elements. However, students this age have never encountered spectrograms and are confused by them when they see them in the alien computer, yet they recognize a need for the information these spectrograms communicate. A number of things happen in class as a result of this miniature problem. First, the teacher can decline to tell students how to get the information they need to interpret the spectrogram and instead use this problem as a vehicle for encouraging collaboration and peer interdependence. Second, it challenges students to investigate more deeply, actively exploring the environment to figure out how to solve this problem themselves. As some students do solve it, they become experts on this particular problem, and when their peers seek help they can provide it. Finally, these miniature problems provide a jumping off point for rich class discussions. For example, the spectrogram problem can lead to discussions on spectroscopy or starlight. The miniature problems within *Alien Rescue* can lead to class discussions on a wide variety of science topics, including radio waves, magnetic fields, Galileo and the moons of Jupiter, geological activity, supernova, ice, gravity, meteors, and atmospheres.

*Provide access to all necessary information within the environment without suggesting the usefulness of that information in the development of a solution.* One reason that teacher development of PBL programs is so difficult is that students must have access to an adequate number of resources to meet their learning needs, but not so many that they are overwhelmed and unable to find the information they need. By providing all necessary information within the program, designers of computer-based PBL programs can assure its accessibility. However, providing a single, well-structured informational resource can limit the range of considerations students make, suggesting a solution without requiring sufficient cognitive effort on the part of the learner.

Because one of our goals in *Alien Rescue* was to promote students' mindful search for useful information, we wanted to avoid providing resources that encouraged a passive page-turner mode of use, or which were structured to suggest certain solutions. To accomplish this, we used two strategies to maintain the complexity of

real-world problem solving and create a need for students to work purposefully. First, more information than is needed is included in the program so that students must discriminate between what is useful and what is not. For example, the alien computer contains information about the aliens' needs, but it also contains information about the uninhabited worlds in their solar system, their journey, and their languages. Second, the needed information is divided among multiple tools so that students must consider a variety of data sources. Some of these resources are purely informational, while others require students to conduct investigations to collect data. For example, the Solar System Database contains text and graphics, while the probe simulation requires students to design probes, launch them, and interpret the data returned from them. Taken together, these strategies encourage students to think about what information they need before conducting research so that they are not overwhelmed by irrelevant facts. This balance of accessibility and complexity makes it possible for learners to be successful within a challenging program.

*Use spatial relationships to help users become familiar with the tools available within the environment.* The large number of informational resources and organizational tools users need within a PBL environment presents a challenge for the design of the interface. Information buried several layers deep within the interface may never be found. By their very nature, the problems used in PBL occur within some context; a computer-based program can exploit this quality by creating a virtual setting for students' work. By structuring this virtual setting so that spatial relationships are established among the resources, the interface can help learners understand and remember how to access useful tools.

*Alien Rescue* contains thirteen tools, most with different purposes and interface features particular to themselves. To help learners understand the variety of these tools and their relationships, we created a two-level interface. The first level is the international space station, a futuristic virtual environment which consists of five rooms that learners can navigate among, using the arrow keys on their keyboards. These rooms contain resources students will only need for part of the program. The second level is the goggles interface. In the Opening Scenario, students are told to imagine that they are wearing goggles that provide access to a variety of tools throughout their work. Tabs along the sides and bottom of the screen provide access to these tools, and students can open and close them using the mouse. This two level interface creates relationships between the tools that supports students in discovering and remembering how to access the wide variety of resources available within the program. Our testing with *Alien Rescue* has shown that students are typically able to navigate easily among the various tools by the third day of class, quickly accessing the tools they need to conduct their work.

*Create the need, opportunity, and support for collaboration.* The need for information that is not instantly apparent, a rich context, and the occurrence of numerous small problems within a PBL program all add to the complexity of the task. Unable to handle this complexity individually, students naturally seek support. In *Alien Rescue*, we typically witness students first turning to their teachers for help. But when the classroom teacher refuses to solve their problems for them and instead directs them toward their peers, students begin to understand the value of collaboration. Allowing and encouraging a collaborative environment within the classroom leads students to see their peers as resources for dealing with difficulties, which in turn can enhance both learning and motivation.

Designers can only control the content of the computer-based programs they create; they exercise little control over the real-world contexts in which the program is used. Therefore designers can only create a need for collaboration. Providing the opportunity and support for collaboration is the responsibility of the classroom teacher. Support materials for teachers should therefore include strategies on how to encourage and support collaboration. The teacher's manual for *Alien Rescue* offers three strategies that teachers can use to support collaboration. First, as described above, teachers can redirect students' questions to their peers. This giving and receiving of help lays a groundwork for more complex forms of collaboration, such as shared planning and division of labor. As some students begin to develop ongoing collaborative relationships with a few peers, teachers can use a second strategy, peer modeling, to encourage greater collaboration among other students. In peer modeling, the teacher asks students who are successfully collaborating to describe their process to their classmates. Teachers may guide this description through the use of specific questions, but they make it clear that students developed and control their own process, and that there is more than one way to collaborate successfully. Through the use of peer modeling, teachers provide students with examples of the logistics of collaboration and legitimize it as a successful strategy for accomplishing complex tasks. Finally, teachers are encouraged to discuss the role of collaboration in the scientific community. One of the goals of *Alien Rescue* is to help students understand the real work of scientists, and that work is usually conducted within collaborative communities. Teachers can describe how scientists typically work in research teams, pooling their various areas of expertise and sharing the responsibility for the investigations they conduct. They can also explain the importance of scientists publishing their findings and building on the work of other scientists. Again, this strategy legitimizes collaboration by framing it as an aspect of the work of "real" scientists.

Designing effective PBL programs is a complicated affair, and this paper addresses only a few of the lessons learned through the process of designing *Alien Rescue*. As problem-based learning becomes a more widely accepted approach, more discussion is needed about effective design principles.

For more information on *Alien Rescue*, visit our website at [www.alienrescue.com](http://www.alienrescue.com).

## References

Albanese, M. A., & Mitchell, S. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. *Academic Medicine*, 68, 52-81.

Aspy, D. N., Aspy, C. B., & Quinby, P. M. (1993). What doctors can teach teachers about problem-based learning. *Educational Leadership*, April, 22-24.

Blumberg, P., & Michael, J. A. (1991). The development of self-directed learning behavior in a partially teacher-centered problem-based learning curriculum. *Teaching and Learning Medicine*, 4, 3-8.

Gallagher, S. A., Stepien, W. J., & Rosenthal, H. (1992). The effects of problem-based learning on problem solving. *Gifted Child Quarterly*, 36(4), 195-200.

Stepien, W. J., Gallagher, S. A., & Workman, D. (1993). Problem-based learning for traditional and interdisciplinary classrooms. *Journal for the Education of the Gifted*, 16(4), 338-357.

Williams, S. M. (1993). Putting case based learning into context: Examples from legal, business, and medical education. *Journal of the Learning Sciences*, 2, 367-427.

# Images of United States and Polish Cultures from U.S. and Polish Perspectives: A Telecommunications Partnership

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## Abstract

*Trigger visuals (Cyrs, 1997) created by graduate students using MacroMedia Director in a Computer Graphics for Learning course in the United States and in a Visualization for Learning course in Poland were shown. These were shared among the U.S. and Polish students and were discussed in Web-based computer conferences. The content and style of the U.S. students' visuals were analyzed by both U.S. and Polish students as well as the researchers to reveal culture as it was manifested through the students' art shared over geographic distances*

## Overview

Graduate students in a Computer Graphics for Education course in the United States and in a Visualization course in Poland created multimedia “trigger visuals” using multimedia software. The “trigger visuals” presented a scenario, problem, or opportunity in order to trigger an emotional rather than a rational response from the viewer and to stimulate discussion (Cyrs, 1997). Then students attempted to share their visuals with each other as Web documents on a shared Web site and discussed their contents in computer conferences. The content and style of the U.S. students' visuals were analyzed by both U.S. and Polish students as well as the researchers to reveal culture as it was manifested through the students' art shared over geographic distances.

## Theoretical Framework

Multicultural understanding is the appreciation of both similarities and differences as well as beliefs, experiences, values, and behaviors across distinct and identifiable cultures within and across groups and societies (Timm, 1996). A group's beliefs, experiences, values, and behavior can be revealed through its artistic creations. Artistic style is “visual synthesis of the elements, techniques, syntax, inspiration, expression, and basic purpose” (Dondis, 1973). This style “describes the means by which aesthetic ends are achieved, the values reflected in those ends, and the culture within which those values prevail” (Mullet & Sano, 1995).

Several telecommunications exchange projects have emphasized the educational goals of equity and multicultural understanding. For example, AT&T Learning Circles were found to reduce isolation and broaden students' experiences (Riel, 1995). Similarly, rural Ohio high school students who exchanged email with adult mentors realized that, “[t]he components of a meaningful life had apparently changed as a result of their interaction with others from outside their usual circle of contacts” (Tille & Hall, 1998, p. 116). Another study explored cultural similarities and differences manifested through children's artwork shared via telecommunications among four teachers and their students in Texas and in Mexico (Cifuentes & Murphy, 2001).

According to Hofstede (1997), cultures differ across four dichotomous dimensions: large vs. small power distance, strong vs. weak uncertainty avoidance, individualism vs. collectivism, and masculinity vs. femininity. These four dimensions are described in depth by Hofstede and can be used to understand and explain phenomena in cultures. For instance, Hofstede used the four dimensions to characterize interactive styles across several nationalities.

Cultures also differ in their communication styles. Hall (1976) distinguishes between high context communication and low context communication. In high context cultures such as that of Poland, communication relies on indirect verbal messages that are dependent on context clues. In such cultures, “very little is in the coded, explicit, transmitted part of the message” (p. 91). Thus students in high context cultures are likely to write less and rely more on the physical context. In low context cultures such as that of the United States, on the other hand, messages tend to be direct, explicit, and highly structured. Understanding these differences is critical for

telecommunications partners with different cultural styles. Clearly, there is much to learn from multicultural and intercultural experience.

## Methods

An instructor in Texas and one in Poland each required their students to develop trigger visuals. The 20 U.S. students were required to post them on the Web. Four Polish students participated. Students were then encouraged to discuss the contents of the visuals in computer conferences using FirstClass™.

We used the two-phase process of content analysis, open coding and focused coding as described by Emerson, Fretz, and Shaw (1995), to analyze the trigger visuals (*see: Boud, Pearson, 1984; Cullen, 1989; Dylak, 1995*) created by U.S. students and the computer conferences. During open coding we analyzed the visuals to identify ideas, themes, or issues (*if it make sense – inspired or triggered*). This process involved writing initial memos to ourselves (Miles & Huberman, 1994). For focused coding, we examined the visuals as well as our memos on a item-by-item basis, giving special attention to categories identified during open coding, Hofstede's four dimensions, and Hall's theory of context. Doctoral students received training and then examined the visuals to categorize them according to those dimensions and provided a rationale for their categorization. They independently completed a matrix of the dimensions as manifested through the visuals for the U.S. students' cultures. After compiling students' categorizations and rationales in a summary matrix, we paid closest attention to the students' rationales. Next, we will insert our own judgment and understanding to summarize and draw conclusions about the data.

## Findings and Educational Value

Artifacts have been collected and analyzed; however, it is too soon to draw conclusions regarding what data reveal about the cultures. Learning networks allow students to virtually cross borders to collaborate with distant others so that they "actively construct knowledge by formulating ideas into words that are shared with and built upon through the reactions and responses of others" (Harasim, Hiltz, Teles, & Turoff, 1995, p. 4).

Learning environments composed of multicultural learners can foster understanding between peoples on opposite sides of geographic borders to fulfill the desirable ends of education (Postman, 1995) and prepare students for world citizenship (Parker et al., 1999). Fabos and Young (1999) charge that one way to "cultivate more critical and political sensibilities among students" is to replace existing theories of the "other" or the "foreign" with ones that "relate the content of telecommunication projects to students' individual and collective lives, that analyze broader social and political issues" (p. 241). This study of shared multimedia explored the possibility of learning how to analyze artifacts to gain understanding of distant others. The study demonstrated that students can share artifacts and then interpret them to learn about cultures. They can gain insight regarding each other's similarities and differences by participating in telecommunications partnerships. In networked classrooms students can connect with distant others to learn about and from their perspectives. In addition, distance technologies can foster team teaching and multicultural relationships across geographical distance.

## References

- Boud D., Pearson M. (1984) The use of trigger video as a stimulus for affective learning, in. O.Zuber-Skerrit (ed.) Video in Higher Education. London, Kogan Page.
- Cifuentes, L. & Murphy, K. (2000), Images of Texan and Mexican cultures shared in a telecommunications partnership, *Distance Education*, vol. 21, no. 2, pp. 300-22.
- Cullen P. (1989) Trgger videos in higher education. A paper presented on the International Conference in Humboldt in Berlin.
- Dondis, D.A. 1973, *A Primer of Visual Literacy*, Massachusetts Institute of Technology, Cambridge, Massachusetts.
- Dylak S. (1995) *Wizualizacja w ksztalceniu nauczycieli (Visualization in teacher education)* Poznan, Poland: Adam Mickiewicza University Press..
- Emerson, R.M., Fretz, R.I. & Shaw, L.L. 1995, *Writing Ethnographic Fieldnotes*, *The University of Chicago, Chicago*.

- Fabos, B. & Young, M.D. 1999, 'Telecommunication in the classroom: Rhetoric versus reality', *Review of Educational Research* 4, vol. 69, no. 3, pp. 217-25-student interaction', in *Improving Intercultural Interactions: Modules for Cross-cultural Training Programs*, eds. R.W. Brislin & T. Yoshida, Sage, Thousand Oaks, California.
- Gorski, P. & Covert, B. 'Defining Multicultural Education', *Multicultural Pavilion*  
 <<http://curry.edschool.virginia.edu/go/multicultural/initial.html>>  
 Updated May 2000 (Accessed 15 May 2000)
- Hall, E.T. 1976, *Beyond Culture*, Anchor, Garden City, New York.
- Harasim, L., Hiltz, S. R., Teles, L., & Turoff, M. (Eds.) (1995). *Learning networks: A field guide to teaching and learning online*. Cambridge, MA: MIT.
- Hofstede, G. 1983, 'Dimensions of national cultures in fifty countries and three regions', in *Expiscations in Cross-cultural Psychology*, eds J.B. Deregowski, S. Dziurawiec & R.C. Annis, Swets & Zeitlinger, Lisse, The Netherlands.
- Hofstede, G. 1997, *Cultures and organizations; Software of the mind*. N.Y.: McGraw Hill.
- Miles, M.B. & Huberman, A.M. 1994, *Qualitative Data Analysis* (2nd ed.), Sage, Newbury Park, California.
- Mullet, K. & Sano, D. 1995, *Designing Visual Interfaces: Communication Oriented Techniques*, Prentice Hall, Englewood Cliffs, New Jersey.
- Parker, W.C., Ninomiya, A. & Cogan, J. 1999, 'Educating world citizens: Toward multinational curriculum development', *American Educational Research Journal*, vol. 36, no. 2, pp. 117-145.
- Postman, N. (1995), *The End of Education*, Vintage, New York.
- Riel, M. 1995, 'Cross-classroom collaboration in global learning circles', in *The Cultures of Computing*, ed S. L. Star, Blackwell, Great Britain.
- Tiessen, E.L. & Ward, D.R. 1998, 'Creating shared understanding through distributed learning', in *Wired Together: The Online Classroom in K-12, Vol. 1: Perspectives and Instructional Design*, eds Z.L. Berge & M.P. Collins, Hampton, Cresskill, New Jersey.
- Tille, M.A., & Hall, B. (1998). 'Connecting to a meaningful life: A case study', in *Wired Together: The Online Classroom in K-12, Vol. 1: Perspectives and Instructional Design*, eds Z.L. Berge & M.P. Collins, Hampton, Cresskill, New Jersey.
- Timm, J.T. 1996, *Four perspectives in multicultural education*, Wadsworth, Belmont, California.
- Zey, M., Luedke, A. & Murdock, S. (1999). *Changing Employment Demands and Requirements for College Graduates: Focus Group Interviews with Industry, Agency, and School District Representatives in Texas*. Strategic Policies Research Group, Texas A&M University, College Station, Texas.



# Visualization for Construction of Meaning During Study Time

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## Abstract

*This study investigated skills that lead to generation of facilitative visualizations during study time for college age students. An orientation prepared students in an experimental group to 1) identify the underlying structure of a given text, 2) represent identified interrelationships, 3) generate pictorial as well as verbal study-notes, 4) visually connect concepts to prior learning, and 5) illustrate distinctive features of concepts. Students who showed interrelationships among concepts in their study-notes performed better on a test on science concepts than those who did not. No other significant effects were identified.*

## Background and Theoretical Perspective

In Visual Communicating, Wileman defines visualization as the process of graphically or pictorially representing facts, directions, processes, data, organizational structures, places, chronologies, generalizations, theories, and feelings or attitudes (1993). In our study, we are interested in the power of student-generated visualization to facilitate learning. As Dewey remarked early in the 20<sup>th</sup> century, the work of instruction would be “infinitely facilitated” if teachers would see to it that their students were “forming proper images.... The image is the great instrument in instruction. What a student gets out of any subject ... is simply the images which he himself forms with regard to it.” Dewey goes on to say that teachers would be wise to spend time “training the student’s power of imagery and in seeing to it that he is continually forming definite, vivid, and growing images of the various subjects with which he comes in contact in his experience” (as cited in Wileman, 1993, p.7).

Student-generated visuals surpass illustrations in their effectiveness for instruction because they are more personally meaningful and relevant to students’ understandings and prior knowledge, and because they contribute to construction of meaning (Anderson-Inman & Zeitz, 1993; Finke, 1990; Gobert & Clement, 1999; Papert, 1991). When students are able to manipulate images during knowledge construction, they tend to engage more in the meaning-making process and understand and remember concepts better than through the traditional transmission approach of instruction (Jonassen, 2000). Additionally, students’ visualizations manifest the content and the structure of their knowledge of concepts, which provides their teachers with access to their levels of understanding.

## Objectives

This study investigated the skills that lead to generation of facilitative visualizations during study time. Specially, researchers examine the effects of teacher encouragement to generate visualizations, the effects of teacher encouragement and orientation to visualization, and the effects of the use of each of four visualization skills and rehearsal on test scores.

## Methods

The participants in this study were 75 undergraduate students in an introductory oceanography course at a large university. Twenty participants were sophomores, 22 participants were seniors, and others are juniors. Of the 75 students who attended class to participate, 27 were male and 48 were female. The participants represented 22 majors from throughout the university. Thirty participants were education majors. The other 45 students were from majors ranging from journalism to biology. Participants were randomly assigned to three groups in a posttest-only-control-group design. The data sources included: (a) test scores, (b) students' study notes, (c) "The Student's Questionnaire", and (d) the researchers' journals.

- **Unguided group**-- received 75 minutes of placebo instruction on use of bacteria to clean the Valdez, Alaska oil spill from the investigator. It then received an essay on the ocean’s role in the greenhouse effect to study and students were given one hour for unguided, independent study prior to taking a test. Students handed in study-notes before being tested on the concepts of the text.
- **Encouraged-to-visualize group**-- received 75 minutes of the placebo instruction from the investigator. It then received the essay on the ocean’s role in the greenhouse effect to study and

students were encouraged to visualize during study time. Students were given one hour for independent study prior to taking test. They handed in study-notes before being tested on the concepts of the text.

- **Oriented group**-- was asked to study two paragraphs of text and handed in their study-notes after studying. Based on the analysis of students' study-notes, the investigator was able to classify the students in this group as either visualizers or non-visualizers prior to receiving the orientation. Then, the group received a 75-minute orientation to visualization from the investigator. It then received an essay on the ocean's role in the greenhouse effect to study and students were encouraged to visualize during study time. Students were given one hour for independent study prior to the test. They handed in study-notes and were then tested on the concepts of the text.

Placebo instruction was designed so that all three treatment-groups would spend equal time with the investigator. For the placebo, the investigator presented a research study on the use of bacteria to clean up oil spills.

The oriented group received a 75-minute orientation to visualization. Students examined short text in order to practice identifying underlying structure of that text that can be expressed as one of the following interrelationships— causal, oppositional, sequential, chronological, categorical, comparative, or hierarchical. The instructor then introduced the students to the concept of self-generated visualization as a study strategy. An advance organizer of the four skills and rehearsal was presented. The four skills were — (1) represent identified interrelationships, (2) generate pictorial as well as verbal study-notes, (3) visually connect concepts to prior learning, and (4) illustrate distinctive features of concepts. The instructor modeled generation of visualizations of the text on the overhead transparency. After each example was modeled, students practiced generating visualizations using each of the skills one at a time. They then shared their visualizations with other students and received feedback from the students regarding the effectiveness of the visualization at communicating the text, which was visualized. Because the training and practice time was limited, students had opportunities to visualize short pieces of text containing only one concept.

The easy for studying was 6 1/2 double-spaced pages of text written at the 12<sup>th</sup> grade level on the ocean's role in the green house effect. All participants took the test at the end of an hour study to determine the effects of the experimental treatment. The test contained 30 multiple choice questions, which was criterion referenced according to the objectives of the test student studied ( $r = .86$ ) and was validated by five oceanographers. The test scores were compared across groups.

In addition, three raters analyzed each student's study-notes and notes in the textual material to estimate the extent to which each student applied the four visualization skills when generating study-notes. Application of each skill was estimated on a scale of 1 to 5 on "The Visualization Skills Inventory" (Cifuentes, 1992). For example, if students made no attempt to show interrelationships they received a 1. If they showed interrelationships with numbering, highlighting, arrows, etc. they scored a 2. If they showed interrelationships through the generation of an outline or other primarily verbal means, they scored 3 points. If they showed interrelationships by creating a structural diagram or a verbal/pictorial representation showing one relationship, they scored 4 points. If they showed interrelationships by creating a structural diagram or a verbal/pictorial representation showing more than one relationship, they scored 5 points (see Figure 1). The interrater reliability was reported as  $r = .97$  for showing interrelationships,  $r = .97$  for balanced pictorial/verbal notes,  $r = .96$  for showing relationships to previously know material and  $r = .99$  for showing distinctive features.

Participants were classified as either visualizers or non-visualizers by examining the unguided group and encouraged to visualize group's study-notes that participants generated while they studied "The Greenhouse Effect" and by examining the study-notes generated by the oriented toward visualization group prior to the orientation. If subjects in each of the groups included any visualization in their study-notes, they were classified as visualizers.

After taking the test, all participants filled in "The Student's Questionnaire" that asked them to rate the extent that they had previously been exposed to the information in the greenhouse effect. To determine if groups varied in their prior knowledge of the textual material, an ANOVA was conducted. No difference was found. The questionnaire also asked students to report the extent to which they used their study-notes to rehearse when preparing for the test. The extent to which students' used their study-notes for rehearsal was estimated from question 1 on the questionnaire. Participants who scored a one or a two were categorized as non-skill-users. Participants who scored a three, four, five or six on were categorized as skill users. Additionally, students were asked to describe in detail the steps that they took to prepare for the test.

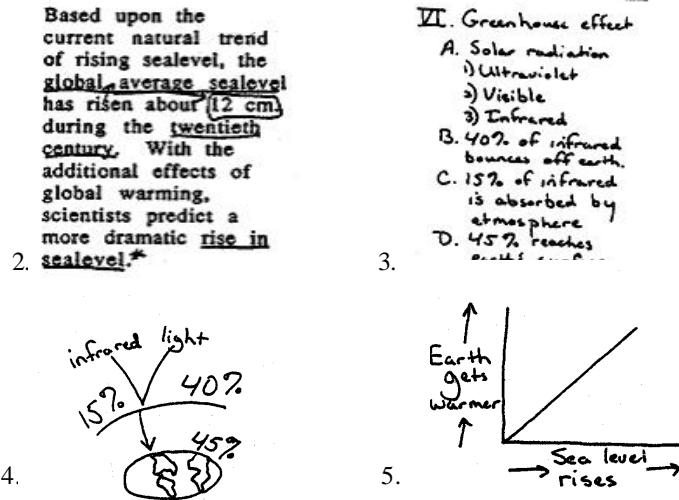


Figure 1. Skill users vs. non-skill users of showing interrelationships after the orientation (scale of 1-5 on each skill).

We applied content analyses approaches, as described by Emerson, Fretz, and Shaw (1995), to the researchers' journal entries, students' study-notes, and questionnaire results. During and upon completion of data collection, we used the two-phase process of content analyses, open coding and focused coding, to analyze the data and identify factors contributing to the effectiveness or lack of effectiveness of visualization as a study strategy for learning the text regarding ocean's role in the greenhouse effect.

## Results

Based upon subjects' self-reports regarding their prior knowledge of the ocean's role in the greenhouse effect, it was determined that groups did not differ in their prior knowledge of the text. However, groups did differ in their use of study time. Most importantly, subjects in the oriented group wanted more study time to prepare for the test while students in the unguided group and the encourage to visualize group wanted less time to prepare for the test.

Regarding subjects' prior knowledge of visualization, 30 of the 75 subjects were education majors and were likely to have been exposed to visualization in education classes at the university. Informal interviews revealed that at least 5 education majors had been exposed to the strategy. Subjects were categorized as visualizers or nonvisualizers based upon their note-taking strategies prior to orientation to visualization. Nine of the 11 identified visualizers were education majors. Results of an ANOVA revealed that there were no significant differences between visualizers and nonvisualizers on the test (see Table 1).

Table 1. Summary of Numbers of Visualizers and Nonvisualizers Before Treatment Per Group and Test Means

	Unguided	Encouraged	Oriented	Total	Mean of Test Score
Visualizer	2	8	1	11	86.06 %
Non-visualizer	18	20	26	64	79.40%

There were no statistically significant differences identified between groups on test scores (see Table 2).

Table 2. Group Contrasts of Performance on the Test

Contrast	df	SS	MS	F	p	Effect Size
Unguided vs Encouraged	1	1.37	1.37	0.16	0.69	0.12
Encouraged vs Oriented	1	2.99	2.99	0.34	0.56	-0.24
Unguided vs Oriented	1	0.18	0.18	0.02	0.89	-0.14

alpha = .017

However, ANOVA revealed that students who showed interrelationships among concepts in their study-notes performed better on the test than did students who did not show interrelationships among concepts in their study-

notes. No other statistically significant differences were found (see Table 3). In addition, Cohen's *d* indicated a positive medium effect size ( $d=0.57$ ) for the pairwise comparison of those participants who showed interrelationships in their study notes and those participants who did not show interrelationships. Additionally, the *d* for the pairwise comparison of those students who balanced their notes pictorially and verbally and those students who did not was 0.37, and the *d* for those students who connected concepts to their prior learning and those students who did not was 0.34. These practical effect sizes indicate that showing interrelationships, balancing pictorially and verbally, and relating new concepts to prior learning made a significant difference on test scores (see Table 4).

*Table 3. Five ANOVA's of the Effects of Four Visualization Skills and Rehearsal on the Test*

Source	df	SS	MS	F	<i>p</i>
<b>Show Interrelationships</b>					
Between Groups	1	42.61	42.61	5.22	0.02*
Within Groups	73	596.06	8.17		
Total	74	638.66			
<b>Balance Pictorially/Verbally</b>					
Between Groups	1	20.94	20.94	2.47	0.10
Within Groups	73	617.72	6.46		
Total	74	638.66			
<b>Relate New to Old Material</b>					
Between Groups	1	17.41	17.41	2.05	0.15
Within Groups	73	621.25	8.51		
Total		638.66			
<b>Show Distinctive Features</b>					
Between Groups	1	6.72	6.72	0.76	0.38
Within Groups	73	631.94	8.66		
Total	74	638.66			
<b>Rehearse</b>					
Between Groups	1	2.22	2.22	0.26	0.61
Within Groups	73	636.44	8.72		
Total	74	638.66			

\*  $p < .05$

*Table 4. Mean Scores and Standard Deviations on the Test for Those Who Used and Those Who Did Not Use Four Visualization Skills and Rehearsal*

Skill Use in Study-notes	N	Test Score Mean	Standard Deviation	Skewness	Kurtosis	Effect Size <sup>a</sup>
Show Interrelationships	52	81.79	9.30	-0.27	-0.42	0.57
Did not Show Interrelationships	23	76.30	9.89	-0.04	-1.23	
Balance Pictorially/Verbally	39	81.82	9.40	-0.27	-0.40	0.37
Did not Balance Pictorially/Verbally	36	78.25	9.93	-0.08	-0.97	
Relate New to Old Material	38	81.76	9.15	-0.33	-0.18	0.34
Did not Relate New to Old Material	37	78.50	10.17	-0.02	-1.00	
Show Distinctive Features	45	80.93	9.80	-0.20	-0.68	0.21
Did not Show Distinctive Features	30	78.86	9.72	-0.21	-0.79	
Rehearse	54	80.46	9.36	-0.29	-0.45	0.13
Did not Rehearse	21	79.19	10.91	0.20	-1.06	

Effect Size<sup>a</sup> =  $(\bar{X}_{\text{show interrelationship}} - \bar{X}_{\text{did not show interrelationship}}) / SD_{\text{weighted}}$

The subjects who were oriented to visualization by the investigator were asked to describe their reactions to visualization as a study strategy. Comments were generally positive. Twenty-one of the 27 subjects used the words "helpful" or "useful" when expressing their opinions of visualization. However, opinions conflicted regarding the efficiency of generating visualizations. Some students felt that the time visualizing was time well spent; others felt that visualization took too much time for busy students whose time is limited. Opinions also conflicted regarding the amount of effort required to visualize. Some felt that visualization was difficult while others felt that it was easy. Conflicts like these indicate that individual differences between subjects contributed to their opinions of visualization. Perhaps the students who found that visualization was easy and time saving were visual thinkers, while those who found that visualization was hard and time consuming were not visual thinkers.

### **Educational Significance**

The study is important in that it provides evidence in the growing body of visualization research. Based upon the findings, it is recommended that students be trained to represent interrelationships that are causal, oppositional, sequential, chronological, comparative, categorical and hierarchical. More powerful orientations to visualization need to be designed and implemented in order to investigate the effects of using visualization instruction on learning. Training sessions might need to be longer than the visualization orientation in this study and should provide more guidance, practice and feedback with textual material that is representative of the length of material that students are required to remember for classroom testing. A study similar to this study should be conducted allowing for flexible study time. In such a study, students would take the test when they want to so that time would not be a limitation. Based upon student behavior in this study, students trained in visualization skills might choose to spend more time on-task and, therefore, might out perform untrained students.

Also, upon development of a reliable and valid measure of visual ability, aptitude-treatment-interaction studies should be conducted to determine ways to adjust instruction to students' individual differences. In this study, some students claimed that visualization was easier or less time consuming than other strategies while other students indicated that visualization was harder and more time consuming than other strategies. Perhaps visualization facilitates learning for visual thinkers but does not facilitate learning for non-visual thinkers.

As well as having differing effects on different learners, visualization may enhance memory more for certain kinds of content than for others. Both concrete and abstract prose recall have been shown to be enhanced by visualization. More studies are needed that compare visualization's effectiveness across various learning domains and various subject matter.

College level educators should not require students to visualize in preparation for a test because visualization may interfere with some students' efficient use of study time. However, we have shown that encouragement to visualize will not interfere with efficient study and may provide students with means to interact with the content they are studying. College level educators should encourage learners to visualize using learner techniques for representing interrelationships that are causal, oppositional, sequential, chronological, comparative, categorical, and hierarchical.

Future research should investigate the impact of the use of computer graphics software, such as AppleWorks™ and Microsoft™ Drawing and Painting tools on the effectiveness of student-generated visualizations. Cifuentes and Hsieh (2001) indicate that having students generate their visualization on computers offer several advantages over pen and paper, such as ease of subsequent revision and effortlessness of creating sophisticated looking graphics. However, learners may be distracted by the fun computer software and the computer graphics tools during learning. More studies need to be conducted in schools with reliable computers to further examine the effect of the use of computer graphics tools on visualization learning.

### **Reference**

Anderson-Inman, L. & Zeitz, L. (1993). Computer-based concept mapping: Active studying for active learners. The Computer Teacher, 21 (1), 6-8, 10-11.

Cifuentes, L. (1992). The effects of instruction in visualization as a study strategy. Unpublished doctoral dissertation, University of North Carolina, Chapel Hill.

Cifuentes, L., & Hsieh, Y.C. (2001). Computer Graphics for Student Engagement in Science Learning. TechTrends, 45(5), 21-23.

- Cognition and Technology Group at Vanderbilt. (1999). Technology for teaching and learning with understanding. Boston: Houghton Mifflin.
- Earnshaw, R. A. & Wiseman, N. An introductory guide to scientific visualization. New York: Springer-Verlag.
- Emerson, R. M., Fretz, R. I. & Shaw, L. L. (1995). Writing ethnographic fieldnotes. Chicago, IL: The University of Chicago Press.
- Finke, R. (1990). Creative Imagery: Discoveries and inventions in visualization. Hillsdale, N.J.: Lawrence Erlbaum Associates.
- Gobert, J. D. & Clement, J. J. (1999). Effects of student-generated diagrams versus student-generated summaries on conceptual understanding of causal and dynamic knowledge in plate tectonics. Journal of research in science teaching, 36(1), 39-53.
- Jonassen, D. H. (2000). Computers as mindtools for schools: Engaging critical thinking. Upper Saddle River, N.J.: Merrill.
- Papert, S. & Harel, I. (1991). Constructivism: Research reports and essays, 1985-1990 Epistemology and Learning Research Group, the Media Laboratory Massachusetts Institute of Technology. Norwood, N.J.: Ablex Publication Corp.
- Wileman, R. E. (1993). Visual communicating. Englewood Cliffs, N.J.: Educational Technology.

# Interface Design and Software Tools for Creating a Multimedia Program Measurement Instrument

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## Abstract

*This paper discussed how the author developed the interface for the Multimedia Program Measurement Instrument based on proven design principles from the behavioral and cognitive sciences and using a variety of software. This is a program developed for her dissertation research<sup>4</sup> which was used for the initial pilot and field testing in the Spring and Summer 2000 semesters followed by a second pilot and field testing and Final Experimentation in the Fall 2000 semester at the University of Central Florida, C&I Instructional Systems. Her study concluded in the Spring 2001 semester. The research study addressed the effect of three types of icon symbol formats viz., abstract, drawing-pictorial, and photographic-pictorial on a user's learning and performance. The measurement instrument consisted of a lesson followed by a quiz on the "Advanced Features of a Digital Video Camcorder". Divided into three parts, the first part discussed the design of the interface and how principles of design were applied for ease of use. The second part of the paper discussed the tools for creating the multimedia program and to capture user's action e.g. clicks and scores on the test. The paper is concluded in the third part with a recommendation for applying similar approach to a variety of uses, whether standalone CD-based or web-based.*

## The Design of the Interface

Factors that were given primary consideration in designing the multimedia (Fleming and Levie (Eds.) 1993) measuring instrument interface for ease of use, mental effort (Winn 1993), attention (Aspillaga 1996) and clarity of presentation were: consistency, predictability, simplicity (Haag and Snetsinger 1993) and information density (Mandel 1997 and Tullis 1997). The program interface starts with a 'welcome login' window where the user enters personal information. The whole experiment is concisely and briefly explained using minimum text and presented via pop up boxes while the user mouse over conceptual words. This is done to minimize a user's mental effort. The user is then familiarized with the lesson interface explaining what to anticipate, what a user is allowed and not allowed to do during the experiment. During the lesson (trials and sections) the user is guided by pop-up text prompts telling the user to go to next lesson, trial or when done with the last trial 3, section<sup>5</sup> to proceed to Quiz.

Using a real-world (Mandel. 1997) digital camcorder metaphor, the screen used a jpeg DVCAM photo (Fig. 1) which served three purposes: as background for the content area (DVCAM) ; as context that acquainted users on the location of the parts and control dials and, as a bounding box that held all icon, text and movie information. This background appeared throughout the Lesson only. For text, the location, size, color and type of font (Ross 1988) stayed the same for different types of information. For example, the font type (AGaramond), color and size and location for the 'Step Number' button stayed the same throughout the lesson. The same rule applies to the heading and prompts. The importance of the text information determined the size of font, i.e. words such as 'Lesson, Camera, Program, VCR and Quiz' needed to be emphasized and had to use (font size 14) than the heading text (font size 12). The icon images were of the same size and location with a buttonized, raised 3-D look. Predictability was solved by using a consistent design of having the icon in the upper left corner, step number on top of the icon, text meaning below the icon and process meaning in motion video on the right of the icon. This arrangement made it easy to locate information minimizing confusion and getting lost on the interface. Textual prompts appeared whenever a section, trial or lesson was concluded, guiding the on what to do and where to click next. The objects on the interface such as the icon, the text explanation and the movie file, which appeared after the icon was invoked, are grouped<sup>6</sup> within a 3.5" radius. I maintained the same radius for presenting single-answer

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<sup>4</sup> Experiment began Spring Semester 2000 and concluded Spring 2001 at the University of Central Florida, Orlando, Florida on UCF Graduate Student Volunteers.

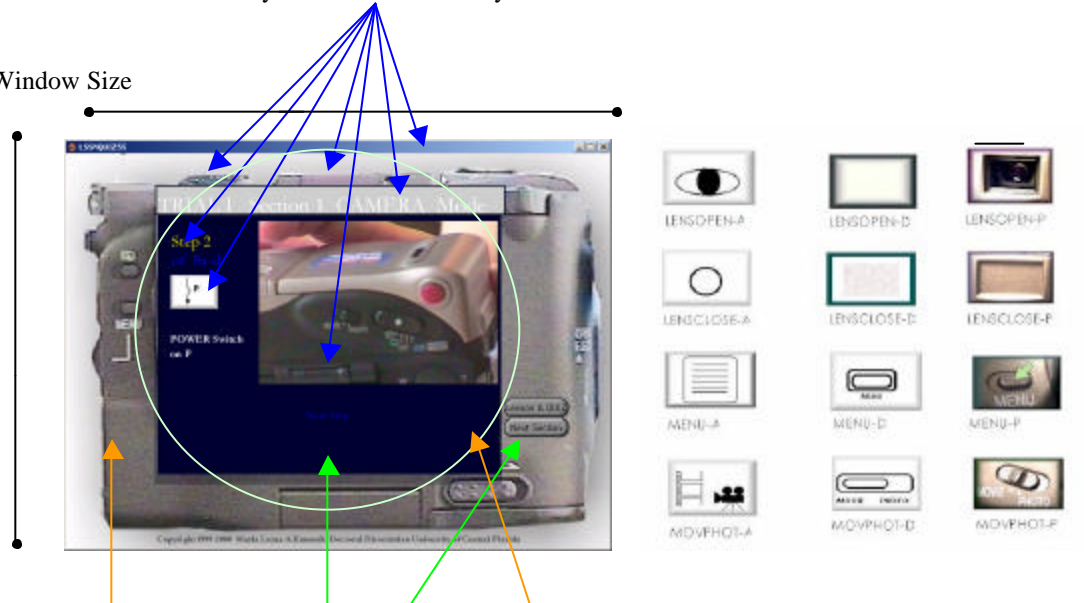
<sup>5</sup> The last part of the lesson

<sup>6</sup> Close Proximity concept – information is processed faster and understood better when located close to one another

multiple-choice question. I used a bigger 4.5” radius for the several answer multiple-choice questions. This avoided the information seeking behavior of the eyes to move around the interface when trying to locate information (Tullis, 1997). This kind of perceptual grouping<sup>7</sup> encouraged to make meaningful associations among the presented information (Winn 1993). Overall, the interface had a simple, uncluttered look.

Location of Information stayed consistent in every window

800 X 600 Window Size



The DVCAM image serves as a contextual background throughout the lesson. Screen color used was black which contrast and made the icons stand out.

Buttons and active links appeared only when needed and prompts appeared only at appropriate times

Fig. 2 Screen Capture of the Lesson Interface (not to scale)

Fig. 1 Buttonized Images

### The Tools

The Lesson was divided into three sections. One section presented the sequential steps to set the Canon ZR digital video DV camcorder DVCAM to CAMERA mode. Once in that mode, the DVCAM can be set up in various ways<sup>8</sup> which will have an effect on the recorded output. For illustrative purposes and to show the basic difference between digital video recording in contrast to standard analog video recording, the option of setting the DVCAM to DIGITAL EFFECTS for the Camera Menu was chosen. The steps lead to finally setting the DVCAM to Digital Effects thereafter showing the different effects one can use for a project. Of the seven<sup>9</sup> built-in digital effects, only four, Fade-Trigger, Art, Sepia and Strobe were used. Another section presented the sequence of steps to set the

<sup>7</sup> Perceptual Grouping – Buttons, objects such as a group of menu buttons, in this case, group of information that relates to the icon being grouped together are meaningfully associated with one another.

<sup>8</sup> Camera Menu options are: Shutter Speed, Digital Effects, Image Stabilizer, Digital Zoom, 16:9, White Balance; Self-Timer; Remote Sensor; Recording Mode; Audio Mode; Wind Screen; Backlight; Brightness, Date and Time set.

<sup>9</sup> Fade Trigger-At Start, the scene gradually fades in from a black screen. When stopped, it gradually fades out; Wipe-At Start, the picture begins as a thin vertical line in the center of the screen gradually expanding sideways to fill up the whole screen. At Stop, the image is wiped from both sides of the screen; Scroll- At Start the picture appears from the right hand side of screen expanding sideways to fill up the whole screen. At Stop, the image is wiped off. Art- Adds a paint-like solarization effect to the image. Black and White-Records the image in black and White; Sepia-records a monochrome image with a sepia tint; Strobe-On-screen actions become a series of still images i.e. slow motion effect.



DVCAM to PROGRAM Mode. In this mode, six options<sup>10</sup> are available to suit the recording environment. For illustrative purposes the LOW LIGHT option was selected. When set to Low Light, the DVCAM can record in dimly-lit places. The other section presented the sequence of steps for setting the DVCAM to VCR mode. When in the VCR mode, a user can view the recorded product.

Each step is represented in three different icon design. For that reason, MS Image Composer and JASC PaintshopPro<sup>11</sup> were used. Image Composer was useful for minimum photographic image enhancements such as cropping, erasing, sharpening, blurring and texturizing. PaintshopPro, another image editing software's, Drawing Tool, not only allowed freehand drawing of shapes, geometric shapes, vector arrows etc. but also allowed enhancing of graphic objects. Through its Image and Effects Menu, I was able to fill shapes e.g. arrows with colors, rotate the vectors and enhanced their brightness and illumination. The last feature was particularly useful in enhancing the photographic-pictorial symbols resulting in a sharper, clearer image. When all the graphical digital assets were completed, each one was given a uniform dimension and applied a Buttonize effect giving it a raised clickable 3-D look (Fig 2). Video files were created by first recording the different steps in analog format. Using a software converter called DAZZLE, these analog files were converted into MPEG files. Once captured and saved onto the PC's hard drive, these MPEG files were enhanced, edited and cut. When set in Snap Capture and View mode, these same MPEG files were used to extract JPEG images as well. To create the entire multimedia program, Macromedia Authorware Attain 5 was used. Authorware is an object-oriented, multi-platform authoring tool which recognizes various file formats for animation, audio, video, text and graphics. Knowledge Objects are mini programs that can be added to the main authorware application. In Authorware there is a Quiz Knowledge Object, an Application Knowledge Object, a Movie Controller Knowledge Object etc. Its Knowledge Objects Application shell was used to develop the LOGIN portion which is where the user inputted personal information such as name (first, last and middle) and subject number. The rest of the multimedia measuring instrument program was completed using the flowchart, icon-based authoring approach.

Once operational Camtasia, a screen recording software was used to track user's actions. Time and scores on the quiz were captured on the hard drive. These MPEG files dynamically recorded all user actions in real-time which can be replayed and reviewed. User's behavior on the program such as movement of the cursor appearing as an arrow or a hand can be observed and counted during replay.

## Conclusion

The behavioral and cognitive design principles that guided the creation of the multimedia measuring instrument can be used for similar learning, performance and evaluation exercise for different content areas in interactive simulations, CD or web-based training and other technology-related training. The tools I used for creating the instrument are but a few of the many applications available. It is now common practice to download trial versions of software<sup>12</sup> for 30-45 functional days. After the elapsed period, these downloaded applications will stop working and will prompt the evaluators to purchase the product. Much of my instructional technology application try outs are done this way.

## References

1. Aspillaga, M. (1996). Perceptual foundations in the design of visual displays. Computer in Human Behavior, 12(4), 587-600.
2. Fleming, M. and Howard Levie, W. (Eds). (1993). Instructional Message Design Principles from the Behavioral and Cognitive Sciences. Educational Technology Publications, Englewood Cliffs, NJ.
3. Haag, B. and Snetsinger, S. (1993). Aesthetics and screen design: an integration of principles. In Visual Literacy in the Digital Age: Selected Readings From The Annual Conference Of The International Visual Literacy Association, USA, 25, 92-97.
4. Mandel, T. (1997). Elements of user interface design. New York, NY: John Wiley and Sons, Inc.
5. Park, I. and Hannafin, M. (1993). Empirically designed guidelines for the design of interactive multimedia. Educational Technology Research and Development 41(3), 63-85.

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<sup>10</sup> Auto

<sup>11</sup> Evaluation version downloadable at [www.jascpaintshoppro.com](http://www.jascpaintshoppro.com)

<sup>12</sup> [www.macromedia.com](http://www.macromedia.com) [www.jascpaintshoppro.com](http://www.jascpaintshoppro.com) [www.techsmith.com](http://www.techsmith.com)

6. Ross, S. (1988). Text density and learner control as design variables with CBI and print media. In Proceedings Of Selected Research Papers Presented At The Annual Meeting Of The Association For Educational And Communications Technologists AECT, USA, 671-690.
7. Tullis, T. (1997). Screen Design. In Helander, M., Landauer, M. and Prabhu, P. (Eds.), Handbook of Human-Computer Interaction (pp. 503-531). Amsterdam, the Netherlands: Elsevier Science;
8. Winn, W. (1993). Perception Principles. In Fleming, M. and Howard Levie, W. (Eds). (1993). Instructional Message Design Principles from the Behavioral and cognitive Sciences. Chapter 2. Educational Technology Publications, Englewood Cliffs, NJ.

# Fulfilling the Promise of Electronic Portfolios

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## Abstract

*Electronic portfolios have great potential for promoting reflective independent learning at all grade levels, from elementary school to graduate teacher training. Developing an electronic portfolio, however, involves mastering both the complexities of designing and developing portfolios and the complexities of designing and developing multimedia and/or World Wide Web materials. This paper presents strategies for efficiently, effectively, and economically carrying out the multiple processes involved in electronic portfolios, emphasizing strategies that work in real-world settings.*

## Fulfilling the Promise of Electronic Portfolios

Assessment is the “glue” that holds together planning and instruction. A growing trend in educational assessment is the attempt to develop and use more authentic, performance-based assessment procedures and tools. Authentic assessments provide students the opportunity to demonstrate, rather than tell or be questioned about, what they know. The use of portfolios to assess student learning is an approach to authentic assessment that is increasing in popularity at all levels of education, from elementary school (e.g., Fogarty, 1996) through graduate teacher training (e.g., Krause, 1996).

## The Portfolio Process

Portfolios are more than a collection of artifacts; they are “a systematic and organized collection of evidence used by the teacher and the student to monitor growth of the student’s knowledge, skills, and attitudes.” (Vavrus, 1990, p. 48). Portfolios enable students to become more aware of themselves as learners and to take ownership in the processes and outcomes of their own learning.

Danielson and Abrutyn (1997) identified four basic steps in the portfolio development process. Portfolio development begins with the *collection* process. Students assemble work samples and other materials that demonstrate the processes and products of their learning, based on the purpose of the portfolio. The next step is *selection*, in which the student selects examples of his or her best work (for a product portfolio) or work that exemplifies specific criteria (for a process portfolio). Students should select sufficient materials to demonstrate the full range of their learning.

A third (and key) step in the portfolio development process is *reflection*. Students analyze each item they include in their portfolio to identify ways in which developing or collecting the item contributed to their learning. The reflective process is a tool for the analysis of learning and self-growth. In reflecting on each item in their portfolio students go beyond summaries to analyze and synthesize their knowledge, skills, and attitudes as they develop. Students who are new to portfolios will need considerable guidance and practice in order to develop the ability to engage in insightful, higher-order reflective thinking. Reflections can be categorized as: (1) *reflection-on-action* (looking back and reviewing what was done); (2) *reflection-in-action* (reflecting while in the act of carrying out a task); and (3) *reflection-for-action* (reviewing what was done and identifying future actions and improvements) (Killian and Todnem, 1991).

The final step in the portfolio process is *projection*, in which students look ahead to where their learning will take them. They set goals for the future, and examine their past work in order to identify patterns, strengths, and weaknesses.

## The Potential Role of Technology in the Portfolio Process

Traditional portfolios are print-based. However, as new and more powerful technologies become a regular part of learning and instruction, more and more teachers and teacher educators are seeking ways to use various technologies to create electronic portfolios (Barron, (2000); Venezky (1998)). Electronic portfolios have several potential advantages over traditional portfolios, and they validate the use of technology as an essential part of learning and instruction for both students and teachers: “Releasing the power of technology in the classroom via

portfolios enables the teacher to reach more students effectively and efficiently, while engaging them in a more realistically meaningful process of learning.” (Cole, Ryan, Kick, and Mathies, 2000, p. 50).

### **Electronic Portfolios: Challenges and Opportunities**

The increased effectiveness and efficiency of electronic portfolios comes at a price. The electronic portfolio process includes all of the complexities of the traditional portfolio process (collection, selection, reflection, and projection). Added to these are the additional complexities associated with designing, developing, and managing electronic (digital) information. Ivers and Barron (1998) have identified five stages in the development of multimedia materials: (1) Decide/assess (determining the goals, audience, and the needs of the audience); (2) Design/plan (identify content and sequence of presentation); (3) Develop (collect and/or generate components); (4) Implement (present the multimedia materials); and (5) Evaluate (measure and judge the effectiveness of the multimedia materials). If the multimedia materials are web-based, an additional layer of complexity is added related to publishing the materials on the World Wide Web (dealing with network protocols, moving and managing information among several different computers, etc.). Both the portfolio development process and the technology design/development process must be carefully coordinated in order to achieve the stated goals of the portfolio process.

Electronic portfolios range in complexity from a floppy disk of word processor files to full-featured World Wide Web sites with extensive multimedia information and interactive capabilities. There is a rather steep learning curve for both teachers and students in becoming adept at developing, using, and managing electronic portfolios. Not all students and teachers will have the knowledge and skills required to use every type of technology they might want to incorporate into their electronic portfolios.

### **Electronic Portfolios: Strategies for Effective and Efficient Use**

Should developing multimedia and World Wide Web design and development expertise be considered part of the portfolio development process or as a separate task? Is there time in the school day to learn new technological tools while at the same time learning about and implementing the complex portfolio process? The strategies presented in the following sections demonstrate the interrelationship between the dual processes of portfolio development and digital media development, and illustrate potential ways to make the development of electronic portfolios a more efficient, effective, and (it is hoped) cost-effective process.

#### **Using Technology to Support and Enhance the Collection Process**

Word processor, spreadsheet, and/or database software can be used as appropriate both to generate and to collect artifacts for the portfolio. It is likely that many of the artifacts to be incorporated into the portfolio already exist as digital files; collecting them as digital information is a logical alternative to producing print versions of the information and trying to organize the large amount of paper typically produced for a portfolio.

Charts, drawings, photos, and other non-print documents can be scanned and converted to appropriate digital form. Digital cameras (still cameras and/or camcorders) can be used to document events and processes in a form that is much more difficult (if not impossible) using traditional portfolio formats. The use of technologies, therefore, enhances not only the depth but also the breadth of the portfolio contents while making it easier to produce and collect relevant information for the portfolio.

#### **Using Technology to Support and Enhance the Reflective Process**

The reflective process is very complex. Technology can support the analysis of learning and self-growth involved in the reflective process in several ways. Even a relatively low-level technology such as a word processor can make recording and organizing reflective statements more efficient. Date and update information can be included in the name of the word processor files, so that the files will be arranged chronologically when automatically sorted by name.

Initially reflective statements can be added to a word processor file as the reflections occur to the student. After reviewing all of the reflective statements, the student can use the outline feature of the word processor to organize and sequent the collection of reflective statements. The various reflective statements can be organized by theme and sub-theme using different levels of headings. Students who have a higher level of proficiency in technology (for example, students proficient in HTML or web authoring tools) can organize their reflective

statements as an interrelated set of web pages. Using web technology make possible the organization of reflective statements in a multi-linked, hypertext format to express multiple interrelationships among reflective statements.

### **Using Technology to Support and Enhance Collaborative Activities**

Portfolios have a dual purpose. They provide a vehicle for self-reflection to guide the student's future learning. In addition, they provide a vehicle to document and to communicate of the student's accomplishments. Technology, especially network technologies, can enhance the collaborative aspects of portfolio development in several ways. Word processor documents and/or web pages that initially were used to collect all possible reflective statements can be edited as part of the selection process of portfolio development. Electronic mail can be used to communicate with co-learners and the teacher, particularly when the communications are the one-to-one type. Co-learners can use the "track changes" feature included in most word processors to embed peer review comments in the student's original file and return the annotated file to the original author.

Presentation technologies such as PowerPoint can be used to develop a summary document that presents the major components, analyses, and reflections contained in the full portfolio. Online discussion groups facilitate distribution of information from the teacher and the sharing of information and resources among students. Students can publish drafts of their portfolios on a web site (either as part of a WebCT or Blackboard course site or on a site developed specifically to support the portfolio process) to facilitate peer review of their portfolios.

### **Using Technology to Support Portfolio Assessment and Presentation**

The same technologies that support peer review and communication can be used by the teacher to provide individualized feedback during the portfolio development process and for assessment of the final version of the portfolio. Teacher comments and suggestions can be directed confidentially to an individual student via e-mail or through a discussion group, or the teacher can use a discussion group to broadcast comments, clarifications, and suggestions that arose in the context of interacting with an individual student to the entire group of students. Comments can be sent to the student via e-mail. Teachers can use the "track changes" feature included in most word processors to return an annotated version of documents with the teacher's comments embedded at appropriate places in the student's original documents.

The use of appropriate technologies also facilitates the teacher's assessment of the final versions of the portfolios. Students can submit the final versions of their portfolios as a folder of files (in Zip form if the files are large) that can be sent to the teacher as an attachment to an email message. If all students are proficient in developing and publishing web materials, students can publish their portfolios on a designated web site. The instructor can then develop (or commission) an "overview/directory" page with links to each student's portfolio.

If students submit their portfolios in digital form (e.g., as a folder containing all of the files that comprise the portfolio contents or as a web page), all of the portfolios to be evaluated can be stored in one place, either on an individual computer or on a web site. This will facilitate both individual assessment and comparison of various students' portfolios.

These same technologies (PowerPoint, web pages, etc.) that students used to develop working drafts of their portfolios can be used to present and distribute the final versions of their portfolios. These technologies make it possible for individuals (a student, a parent, a teacher, a prospective employer of a pre-service teacher) to view the complete portfolio. It is also much easier for a teacher to preserve samples of exemplary portfolios to be used as guidelines for students in future classes.

Students who have the requisite technology skills can transfer their complete portfolio to a CD-ROM for archiving and distribution. Certainly being able to give a prospective employer a CD-ROM provides definite advantages over giving him or her a large bulky binder.

### **Using Technology to Support the Portfolio Process: Questions and Cautions**

The major question to be answered in deciding whether and/or how to implement electronic portfolios is: What is the appropriate use of technology in the portfolio process? In answering this question, one must address (a) the purpose of portfolios in a particular learning situation; (b) the skills and knowledge of the students, both in the area of portfolio development and in the use of various technologies; and (c) the audience for the portfolios (including both immediate and potential long-term audiences).

Several specific questions must be addressed in planning for the use of electronic portfolios and in deciding the extent to which electronic portfolios can be used in a “real-world” situation with a given group of students. These questions include:

What level of technology knowledge and skills do students begin with?

How will students develop additional technology knowledge and skills if they are needed?

What resources (equipment, software, technical support, materials, time) are available to support the development of electronic portfolios?

In answering all of the above questions, and in every phase of the design and development of a technology-based/technology-facilitated portfolio program, the major principle to keep in mind is that learning and the needs of learners should determine which technologies are used and how they are used. Technology should be an enabler, not a driver, of the process. It is hoped that this paper will provide guidance and support to educators already engaged in or considering the use of electronic portfolios.

## References

- Barron, H. C. (2000). Electronic portfolios = multimedia development + portfolio development. Available: <http://transition.alaska.edu/www/portfolios/EPDevProcess.html>.
- Cole, D. J., Ryan, C. W., Kick, F. & Mathies. B. K. (2000). *Portfolios across the curriculum and beyond*, 2<sup>nd</sup> Edition. Thousand Oaks, CA: Corwin.
- Danielson, C., & Abrutyn, L. (1997). *An introduction to using portfolios in the classroom*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Fogarty, R. ed. (1996). *Student portfolios: A collection of articles*. Palatine, IL: IRI/Skylight Training and Publishing.
- Ivers, K., & Barron, A. E. (1998) *Multimedia projects in education*. Englewood, Co.: Libraries Unlimited.
- Killian, J., & Todnem, G. (1991). A process for personal theory building. *Educational Leadership* 48(7), 14-16.
- Krause, S. (1996). Portfolios in teacher education: Effects of instruction on preservice teachers' early comprehension of the portfolio process. *Journal of Teacher Education*, 47(2), 130-138.
- Vavrus, L. (1990). Putting portfolios to the test. *Instructor*, 100(1), 48-63.
- Venezky, R. (1998). Creating and using portfolios on the alphabet superhighway. Available: <http://www.ash.udel.edu/ash/teacher/portfolio.html>.

# Designing Digital Instructional Management To Optimize Early Education

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## Abstract

*Next to playing, matching instructional features with children's characteristics may stimulate children's development in early education. Instructional lines of ordered playing and learning appliances, inclusion of diagnostic and achievement indicators, flexible grouping of students, screening of initial student characteristics, and supportive software, are expected to optimize early education for students and teachers. In two Dutch kindergarten schools, instructional changes were realized in a use-oriented method by co-development with teachers and management. Also, a software prototype designed to manage and optimize early education was developed and tested. Information is given about the digital instructional management prototype, development and implementation experiences in early education, and first effects of using this software in practice. Further possibilities to optimize education in kindergarten and other educational types are discussed.*

Learning and instructional theories focus on individual or small-group learning, although, in school practice, learning usually occurs in the whole group or class (Collier, 1994). Within a whole group, class level learning expectancies, complexities, and norms may then interfere with small-group and individual learning possibilities and potentials. This is true in particular for learners who seem to be at risk in some respect, e.g. a learner functioning relatively low compared to most other learners (Walker, Kavanagh, Stiller, Golly, Severson, & Feil, 1998), or relatively high as specified by e.g. King, O'Shea, Joy Patyk, Popp, Runions, Shearer, and Hendren (1985).

To support development and learning processes and effects, each student's characteristics should be matched with actual instructional and didactic features (Van Merriënboer, 1997). A learner 'deviating' from the other learners may therefore profit most from instructional management designs which optimize teaching and learning for all students actually present in class. However, giving more attention to more details of learning processes requires much, and often too much, of the teacher. As differences in development and learning between children can already be rather huge at the start of kindergarten, providing adequate instruction and prevention of learning de-motivation and problems may become too complicated for the teacher (Jones, Gullo, Burton-Maxwell, & Stoiber, 1998). In this respect, Information and Communication Technology (ICT) can lend a hand (Chang, 2001; Sinko & Lehtinen, 1999). ICT consists of different kinds of electronic hardware and software which, in combination, may support the preparation, execution, and evaluation of networked teaching and learning processes and effects (Lally, 2000).

In research to explore the role of ICT in optimizing instructional and didactic management, qualitative research to model didactic and learning processes was carried out in ten Dutch secondary schools varying in background characteristics (Mooij & Smeets, 2001). Five successive phases and respective models of ICT implementation were found:

1. Incidental and isolated use of ICT by one or more teachers
2. Increasing awareness of ICT relevance for the school, at all levels
3. Emphasis on ICT coordination and hardware within school
4. Emphasis on instructional and didactic innovation and ICT support
5. Use of ICT-integrated teaching and learning, independent of time and place

After acquisition of hardware and software in phase 3, in phase 4 ICT is designed to support learning processes in more flexible and optimizing ways. In phase 5, education is being restructured from the perspectives of the learners. This process requires transformation of teaching and learning processes by changing instructional features and didactic management, in close relationship to ICT conditions supporting both individualized and small-group learning in and outside school.

Optimizing education since the start of kindergarten may be the most promising effort to prevent de-motivation and learning problems (cf. Walker et al., 1998). Therefore, the question for research is how model 5 could be designed and implemented in early education to realize the advantages potentially related to this model, in particular for students at risk. To answer this question, I will first focus on theoretically relevant instructional and

management conditions to support students since the start of kindergarten (cf. Van den Akker, 1999). Next, in co-development with teachers and management, some required educational changes are realized in kindergarten practice. Then, relevant software is implemented and the user effects of this first prototype are revealed and evaluated.

## **Theory**

Bergqvist and Säljö (1998) report about grades 1–3 of four elementary schools in Sweden. The schools use an individualized curriculum in an age-integrated classroom and the students are aged seven to nine. The researchers concentrated on student and teacher cooperation in discussing the student's weekly planning and working or, in other terms, about learning to self-regulate the schoolwork. Their observations reveal that many responsibilities are conveyed from the teacher to the student because social, pedagogical, and learning roles are intricately related to the instructional, didactic, and school-wide curriculum organization of both teaching and learning. Moreover, a student is functioning better if he or she is able to choose playing or instructional activities according to or slightly above his or her actual level of competency within a certain field. Comparable results are found by the American research of Jewett, Tertell, King-Taylor, Parker, Tertell, & Orr (1998) who concentrate on pedagogical and curricular aspects teachers have to realize to help children with special needs in kindergarten. If this matching is not realized, motivation and achievement problems may turn up for students functioning at relatively lower or higher levels of competency than their peers.

Theoretically, curricular features should be designed in such a way that concrete instructional and didactic processes are supporting each learner's activities at any time, in a positive social context. Learning could be designed also for a small group of students helping each other, or collaborating with one other (Jones, Rasmussen, & Moffitt, 1997). In this situation, the teacher's attention can concentrate more on students who most need his or her attention. Such an instructional design would require flexible instructional lines with clear diagnostics next to situations of free playing, including flexible grouping and organization throughout the educational career. On the student's side, it should be clear which competencies, and which initial levels of competencies, should be stimulated in which ways, to optimize developmental progress since the start in kindergarten.

## **Free Playing And Instructional Lines**

In early education, free playing activities are usually based on children's own initiatives and choices (Pellegrini & Boyd, 1993). The concept of 'instructional line' can be used to refer to a specific set of learning activities ordered according to instructional difficulty level or social didactic aspects, e.g. motor behavior, social-emotional development, projects, language and literacy, (preliminary) arithmetic, (preliminary) reading, and (preliminary) writing. The line concept denotes a hierarchical arrangement of curricular concepts and sub-concepts corresponding with specific instructional or didactic play materials, representing specific learning or play activities. For example, sensorimotor development for four- to six-year-olds generally starts with global movement with the whole body, followed by movement with the arms and hands, and then by paying attention to writing conditions, e.g. direction in moving, training of regularity in movement with hands and fingers, and motor exercises evolving into preliminary writing.

## **Diagnostic And Progress Indicators**

Within instructional lines, reliable and valid indicators need to be integrated to diagnose and evaluate learning processes and their outcomes on every student, from the start in kindergarten onwards. Monitoring is important, in particular to realize a timely promotion of the development of children at risk. Also, a standardized diagnostic or age-normed achievement test should be included. Each student's progress can then be evaluated continuously by individual, social, and age-normed diagnostic and achievement tests in the architecture of lines (cf. Byrne, 1998; Wegerif, Mercer, & Dawes, 1998).

## **Flexible Grouping And Organization**

Making the organizational grouping of students more flexible according to learners' characteristics and instructional procedures seems another precondition to promote school careers of students at risk in particular (Bennathan & Coxall, 1998; Cooper & Ideus, 1998). Flexible grouping in small groups can for example be designed on the basis of students' competency levels, learning style, or specific didactic preferences or requirements in case



of certain handicaps. Moreover, flexibilizing of students' grouping can also stimulate cooperation between professionals in and outside school, to support children better than in their earlier development (Mangione & Speth, 1998).

### **Screening Of Children's Entry Characteristics**

Close observation and analysis of interactions between instructional features and students' learning characteristics reveal that development and learning problems may start early in kindergarten (Skinner, Bryant, Coffman, & Campbell, 1998). Given the differences in development between children already at the very start of kindergarten, it is important to present adequate and diverse kinds of playing and learning materials. This is most relevant for children deviating most from the other children in class. To get relevant information as soon as possible, it is helpful to screen a child's starting characteristics by parents at intake, and by the class teacher after the child's first month in school. Communication about differences between the perceptions of parents and kindergarten, and taking adequate curricular action if indicated, can prevent motivational, social, emotional, or cognitive problems of vulnerable students in particular. The teacher or another professional can additionally diagnose or assess characteristics, and assign specific playing and instructional activities to a child or a small group of children, if possible in cooperation with parents. Guidelines to this optimization process are presented and discussed by Mooij, Terwel, and Huber (2000).

### **Software Features**

Initially, it is not clear how software could be designed to support the optimization possibilities sketched above. For this reason, it was decided to first start the developments sketched above in kindergarten practice. In doing this, it could be checked in how far design features of the software could be based upon educational features, and how their specifics had to be to help teachers. At the same time, implementation and first effects of the software could be observed.

### **Method**

The theoretically desirable educational features were not known to exist in practice. Therefore, a developmental project was planned in two regular Dutch kindergartens for children aged four to six. The usual planning system in these kindergartens consisted of a planning board on the wall, with a differently colored column for each day of the week. Small groups of students, corresponding with certain table groups, were indicated by different logos and colors. Activities to be done by a small group were assigned by placing the tags of these students on a logo representing a certain kind of activity, on a certain day of the week, on the planning board.

In the years 1997–2000, teachers, management, and the researcher collaborated to develop instructional lines based on the regular playing and learning appliances in the kindergarten classes. Recent methodology supports a strategy in which users, for example teachers and school staff, collaborate with researchers and other specialists to secure validity of innovation processes (cf. Blumenfeld, Fishman, Krajcik, Marx, & Soloway, 2000; Clark & Estes, 1999; Kensing, Simonsen, & Bødker, 1998). Wils on (1999) expects that 'use-oriented' strategies '(...) increase the likelihood of successful implementation because they take the end use into account at the beginning design stages' (p. 13). This development co-occurred with flexibilization of grouping of students, and the screening of students' entry characteristics by parents and the class teacher.

In the first period, attention was focused on rearranging and registering the appliances to clarify the instructional and didactic aspects of the playing and curriculum system. Next, the use of the registered appliances either by the teacher or by self-management of the students was made concrete. Parallel to this, and in the same collaborative way (cf. Ely, 1999), a first prototype of a computer program was designed and developed. The design concentrated on extending optimization features and possibilities of the planning board, to better assist teachers and students (Crook, 1998). Essential software functions of this 'digital instructional management' were related to registering and manipulating information about instructional lines, students and teachers, and promoting students' instructional self-management. The information from educational practice was collected into digital databases within the framework of a standalone computer.

### **Results**

#### **Software Features**

**Information on Instructional Lines.** A first main feature of the prototype is the creation, change, or removal of an instructional line. Lines developed refer to, for example, motor behavior, social-emotional development, projects, language, (preliminary) arithmetic, (preliminary) reading, and (preliminary) writing. Each instructional line in kindergarten class and, correspondingly, in the software, is characterized by a specific logo, a specific color, and a corresponding name or text. Activities or tasks within each line are visually represented by a photograph of the object as present in class because four-year-olds must be able to work with the program. A screenshot of this feature of the prototype is given in Figure 1.

A second main feature concerns the input, change, or removal of activities or tasks within specific levels of an instructional line. Within a line, activities or tasks are ordered by difficulty level. To stimulate students adequately, variants of lines referring to different developmental levels were constructed for e.g. ‘normal’ students developing in a more or less regular way, students requiring special or remedial activities, and highly able students who are advanced on the topic of the line. Moreover, an activity can be tagged with an indicator meaning that the student has to go to the teacher in order to continue. For example, an indicator may mean that a student’s initial level of language competency has to be screened, as a basis for further support and placements. In the same vein, a standardized diagnostic or achievement test can be included, in particular for measurement with a conspicuous student or a student at risk. Another potential use is the formation of a small group of students by the teacher, to do the tagged activity. A screenshot of ordering an activity by using a photograph, name, and description into an instructional language line at level 6 is shown in Figure 2.

Figure 1. Symbols (Logo, Color, Name Of Line) Representing Four Instructional Lines

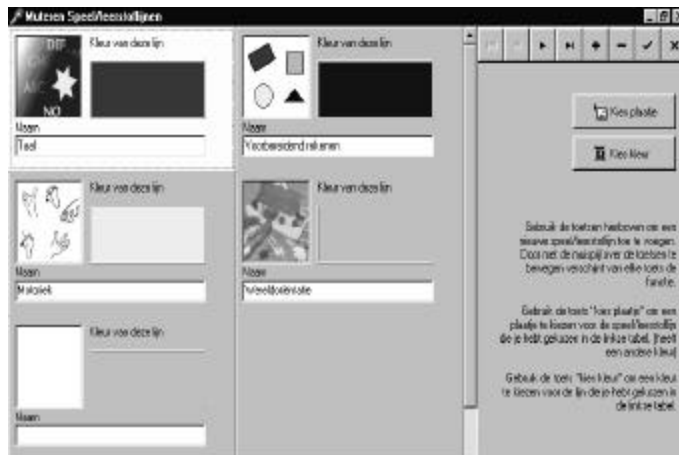
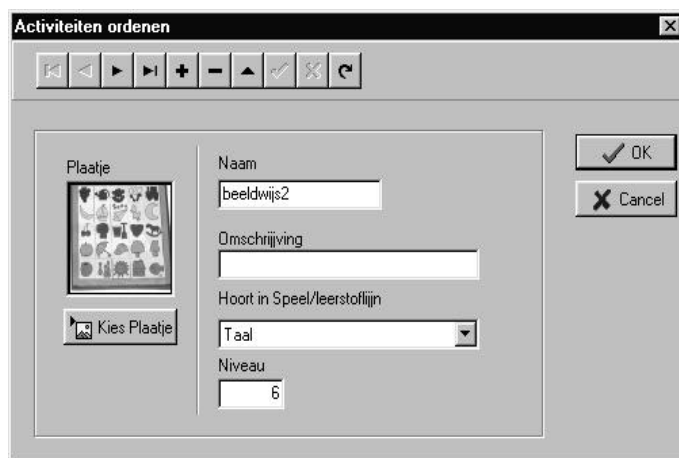


Figure 2. Ordering Of Activity (Photograph, Name, Description) Into Instructional Line And Level

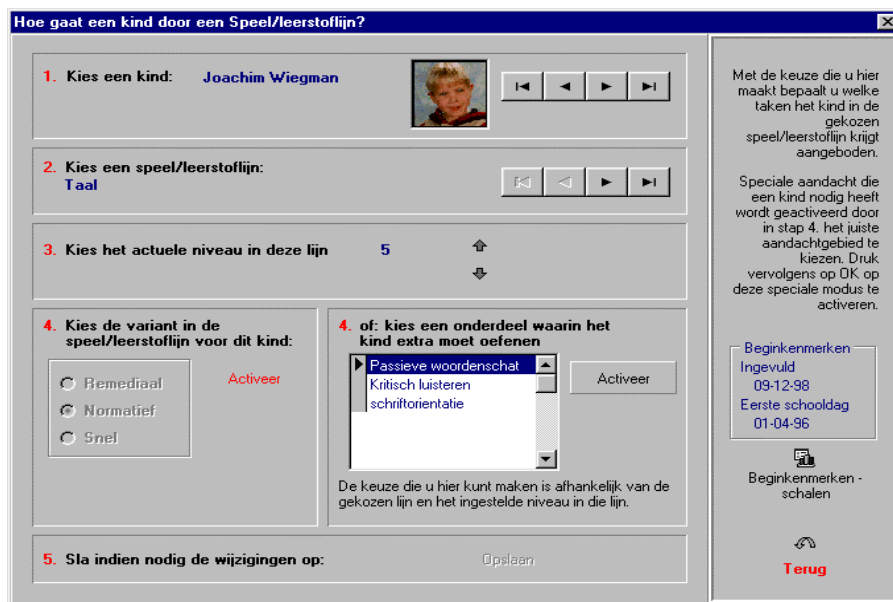


A third feature of the software is the possibility to get an overview of the content of an instructional line, or a set of variants of an instructional line, at a specific level of difficulty.

**Information about Students.** Another main feature of the software has to do with registering administrative information about a student: adding a new student, removing a student, or changing existing information about a student. For example, the teacher can register students by integrating their photographs in the database. The photographs of all children in one class can be shown in one screen. Furthermore, the registering of each student's initial characteristics is carried out in conformance with a psychometrically controlled procedure based on quantitative longitudinal research with 966 four-year-olds (Mooij, 2000). An overview of initial characteristics of a student, and a comparison between the information from parents and teacher, can be produced automatically.

A second main feature here is placing a student within an instructional line. Teachers can insert and order pictures of didactic activities or materials, and assign different activities to different students. A screenshot of these possibilities is given in Figure 3. This figure shows that a teacher can successively select a child (see Program Line 1 with the photograph of the student), select a kind of instructional line (2), the actual difficulty level of this line (3), the variant of the line for the student (remedial, regular, fast, or some specific material: see 4), and finish by saving the changes made (5). The next time this boy accesses the computer software, his choices to play or work are determined by the teacher's instructional management decisions. In this way, the student's choices and consequent activities are regulated by the digital instructional management system. It should be noted that the student is not working on the computer to complete activities, though teachers can of course decide to include this possibility as one of the alternative instructional lines.

Figure 3. Placing A Student Into An Instructional Line, With Level And Other Specifics



Third, the software allows automatic logging of activities for each of the students working with the software.

**Information about Teachers.** Here the most important facilities refer to adding a new teacher to a specific class, removing a teacher, and changing existing information about a teacher.

**Students' Instructional Self-Management.** A student can click his or her own photograph on the screen that contains all the photographs of the students in class. What the computer screen then looks like is shown in Figure 4. The screen shows the photograph and the name of the student (top-right corner). The top-left corner presents the object or material that the student is actually working on. The three icons at the bottom of Figure 4 each illustrate one possibility: the student is ready and wants to stop with this task (left icon), the student wants to select a new activity (middle icon), and the student made a wrong choice and goes back one decision (right icon). Using this interface, the student has to know which virtual assignment corresponds with which real playing or instructional activity in the classroom. Of course, a student can be helped by another student or by the teacher.

Children usually play or work with the real three-dimensional materials, and not on the computer. This feature seems to suit children of this age best, and it also overcomes computer access constraints. Moreover, a teacher can change or extend playing or other structured activities within a line, to improve the educational processes or to check their desired effects on one or more students.

### Functioning Of The Prototype

Implementation and Effects in Kindergarten Practice. First of all, by using the prototype the teachers discovered that their playing and learning activities and materials needed acute extension. This insight was based on the screening of the students' initial competencies by the parents and the class teacher, and the subsequent need to integrate the different levels of initial competence into adequately differentiating playing situations and instructional lines. The differences between their students were much bigger than was accounted for in the available activities, appliances, and materials. A clear consequence was that a great deal of the school budget was spent on buying new playing and learning materials.

Figure 4. Screen Showing The Alternatives Reflecting A Student's Self-Management



Second, teachers learned pedagogically and instructionally relevant relationships between the characteristics and activities of the children, and the use of playing and learning materials and appliances in kindergarten. According to the teachers, this enabled them to use the materials to promote the functioning of the students much better than before. However, teachers took much more time than before to instruct the students. Since the class size (25–30 students) imposed severe time restrictions, the time problem was resolved by calling in parents to instruct specific students. This was not really satisfying. Much more teacher assistance seems needed to adequately integrate student differences present at the start of kindergarten. The software thus highlights that there may be more work than only one teacher in a class can handle.

Third, some of the students of four, five, or six years old learned to get along with the program very soon. They could assist other students too, if necessary. Some of the students had more difficulty in using the program. Because students' self-management was clearly stimulated by the software, the teacher's opportunity to devote more time to the students who needed this assistance most, was enlarged.

Finally, a main experience of all persons involved in the development was that the co-development of curriculum, learning, and ICT conditions in practice started a learning process for all (cf. Remillard, 2000). The collaboration between teachers, management, research, and software developers, according to a use-oriented design, proved to be very worthwhile.

Potential to Optimize Instructional Management. The first prototype in kindergarten suggests more possibilities of software to optimize instructional and didactic management processes. Instructional lines can

function as main vehicles to explicitly define, integrate, and evaluate curricular features and processes, diagnostics and specific assessments, and learning processes, at different educational levels simultaneously. In addition to ordering and presenting instructional lines, ICT can help to diagnose and assess each student's progress in both individual and group-normed ways, and to construct specific instructional lines for marginal students or students at risk, if necessary in collaboration with external specialists. ICT can also support networked instructional and didactic management for various types of users at different levels of the educational system, e.g. students, teachers, school administration and school management, and external professionalists (see e.g. Tymms, Merrell, & Henderson, 2000). An explorative overview of relevant levels, potential users, and optimization functions of ICT, is given in Table 1.

Table 1. Optimization Functions Of ICT At Various User Levels

<i>Users / High-Low Educational Levels</i>	<i>Optimizing Functional Features of ICT</i>
Policy / Development / Research	Collect and evaluate data from (interactions between) curriculum and learning at all levels. Plan, coordinate, develop, evaluate quality aspects and optimization of curriculum / learning.
Regional Instances (e.g. School Psychologists, Advisors, Youth Aid, Municipal Policy)	Aggregation of in-school data to data at regional level and regional developments. Plan, coordinate, develop, evaluate quality aspects and optimization of curriculum / learning. Develop and evaluate qualities of regional features relevant to curriculum / learning. Develop, evaluate optimization of curriculum / learning re. students and specific students at risk. Collaborate with school / location management, teachers, students, and parents.
School Board, Management, Staff	Analysis of curriculum / learning data re. unit / location / school level and developments. Plan, coordinate, develop, evaluate quality aspects and optimization of curriculum / learning. Develop, evaluate optimization of curriculum / learning re. students and specific students at risk.
Teachers	Analysis of curriculum / learning data re. student / (small-) group level and developments. Plan, coordinate, develop, evaluate quality aspects and optimization of curriculum / learning. Develop, evaluate optimization of curriculum / learning re. students and specific students at risk. Complete / change / output indicators re. level-specific curriculum and student characteristics. Complete / change / output indicators re. instructional lines and groupings for student(s). Complete / change / output (normed) indicators on individual and group achievement.
Parents	Completion of initial and other competencies of their own child. Overview of their child's developments and progress ('virtual portfolio').
Students / Learners	Automatic logging and storing of activities chosen, and logging of processes and results. Select actual or next instructional line, and actual or next activity. Plan, coordinate, develop, evaluate quality aspects and optimization of curriculum / learning.

**Integration of Diagnostic and Achievement Evaluation.** The evaluation of the prototype also suggests the specification of three kinds of activities within an instructional line: regular activities, evaluative activities, and normed activities. Normed diagnostic and achievement indicators in instructional lines are defined as representing a generally valid kernel structure of pedagogical-didactic features of the curriculum. This kernel allows a structured diagnostic evaluation of a child's characteristics and progress in individual, social or group, and normed respects, in the course of time. Such a multidimensional evaluation scheme is needed to provide a complete responsible stimulation of the development of a child, from the start in kindergarten onwards. Moreover, the kernel structure can be changed locally or extended into local instructional lines which better fit situational teaching or learning conditions, as long as the normed referents in the lines are kept intact. The same or comparable indicators can be used as a common frame of reference for the preventive commitment of external specialists like a school psychologist (cf. Griffin & Beagles, 2000).

## Discussion

In a four-year project, attention was focused on the improvement of early educational practice in kindergarten. To this end, instructional lines with respect to ordinary playing and learning appliances were co-developed with teachers and management. Ordering of instructional, didactic, and diagnostic materials occurred with symbols (logo, color, names) to make them concrete for young children. Also, software was developed and used in two classrooms to check their functioning in educational practice.

The results can be summarized as follows. First, starting characteristics of each student are measured and discussed systematically by parents and teacher. Problems or risk characteristics can get more systematic and

preventive pedagogical attention, if necessary by early inclusion of specialists outside school. This means that preventive cooperation between parents and kindergarten teachers can increase considerably in comparison with current practice in early education.

Second, next to the usual free-playing and whole-group sessions, each student can now get systematic and immediate curricular support at his or her own levels of competency. Controlled specific support can become available for the students who need this. Also, automatic logging and monitoring of student and class or school results becomes available, which is not dependent on only one teacher or small group of teachers.

Third, the software allows a growth in the independence, self-regulation, and self-responsibility of the students, which is also possible because the students themselves can assist each other in communicating with the computer. This advantage will increase when the students get older.

Fourth, specific operationalization of e.g. giving equal opportunities to students from ethnic minorities, introducing quality standards in education, or increasing safety at school becomes possible. Here, systematic innovation support will be needed in the developing kindergartens and schools. In the long run, the software can act like a supportive planning and instructional management system for teachers, students, the school, the school board, and the parents alike.

Fifth, though quantitative data are not yet available, the hypothesis seems legitimate that the use of digital instructional management in early education will stimulate the optimization of educational processes and outcomes. Compared with traditional early education, more prosocial and constructive learning processes can be realized in practice, in collaboration between teachers and school staff, students, parents, and specialists from outside school but working within the framework of the same instructional lines and progress evaluation. Quantitative research to verify this hypothesis for students at risk in particular should be designed, but until now research facilities are only present for developmental follow-up projects. A first project in early and primary education concentrates on developing the pedagogical-didactic kernel structure, as defined above. Moreover, implementation in practice co-occurs with development and implementation of a second prototype of the digital instructional management system. The design of this Internet-based software is specified on the outlines given in Table 1.

A second follow-up project is carried out in secondary education. First, local instructional lines are developed and introduced in school practice. Teachers develop these lines within a self-chosen project on 'Water and environment', for small groups (2-4) of students. To aid the self-management of students, teachers create activity worksheets for each activity within the instructional lines. The worksheets contain aspects of preparatory instructional specifics, the actual performance, and the evaluation of project activities. Curriculum and learning materials are present in or around the classroom, school library, or the Internet. The worksheets provide instructional information about learning processes, materials and sources, appliances that can be used, and diagnostic evaluation. Evaluation and judgment become more individualized, but reliable or valid achievement indicators or norms hardly exist at present. Development of such indicators will become possible by authoring Internet-based software, comparable to the second prototype for early education. This prototype for secondary education is now under development.

## References

Akker, J. van den (1999). Principles and methods of development research. In J. van den Akker, R. Maribe Branch, K. Gustafson, N. Nieveen, and Tj. Plomp (Eds.), Design approaches and tools in education and training (pp. 1-14). Dordrecht, The Netherlands: Kluwer.

Bennathan, M., & Boxall, M. (1996). Effective intervention in primary schools. Nurture groups. London: David Fulton.

Bergqvist, K., & Säljö, R. (1998). Construction of curricular content in the individualised age-integrated classroom. Paper presented on the 'European Conference on Educational Research' (ECER), Ljubljana, Slovenia, 17-20 September 1998. Linköping / Göteborg, Sweden: Linköping University / Göteborg University.

Blumenfeld, Ph., Fishman, B. J., Krajcik, J., Marx, R. W., & Soloway, E. (2000). Creating usable innovations in systemic reform: Scaling up technology-embedded project-based science in urban schools. Educational Psychologist, *35*, 149-164.

Byrne, B. (1998). The foundation of literacy. The child's acquisition of the alphabetic principle. Hove, UK: Psychology Press.

Chang, C.-C. (2001). A study on the evaluation and effectiveness analysis of web-based learning portfolio. British Journal of Educational Technology, *32*, 435-458.

Clark, R. E., & Estes, F. (1999). The development of authentic educational technologies. Educational Technology, *39* (2), 5-16.

- Collier, G. (1994). Social origins of mental ability. New York: Wiley.
- Cooper, P., & Ideus, K. (1998). Attention Deficit / Hyperactivity Disorder. A practical guide for teachers. London: David Fulton.
- Crook, Ch. (1998). Children as computer users: The case of collaborative learning. Computers & Education, 30, 237-247.
- Ely, D. P. (1999). Conditions that facilitate the implementation of educational technology innovations. Educational Technology, 39 (6), 23-27.
- Griffin, S. L., & Beagles, Ch. A. (2000). Training and performance support systems (TPSS): a case study from needs assessment to return on investment. Educational Technology, 40 (5), 34-42.
- Jewett, J., Tertell, L., King-Taylor, M., Parker, D., Tertell, L., & Orr, M. (1998). Four early childhood teachers reflect on helping children with special needs make the transition to kindergarten. The Elementary School Journal, 98, 329-338.
- Jones, B. F., Rasmussen, C. M., & Moffitt, M. C. (1997). Real-life problem solving. A collaborative approach to interdisciplinary learning. Washington DC: American Psychological Association.
- Jones, I., Gullo, D. F., Burton-Maxwell, C., & Stoiber, K. (1998). Social and academic effects of varying types of early schooling experiences. Early Child Development and Care, 146, 1-11.
- Kensing, F., Simonsen, J., & Bødker, K. (1998). MUST: A method for participatory design. Human-Computer Interaction, 13, 167-198.
- King, E., O'Shea, A. A., Joy Patyk, L. I., Popp, L. A., Runions, T., Shearer, J., & Hendren, R. T. (1985). Programming for the gifted. Ontario: Ministry of Education.
- Lally, V. (2000). Analysing teaching and learning in networked collaborative learning environments: issues in work and progress. Paper presented at the European Conference on Educational Research, University of Edinburgh, September 2000. Sheffield, UK: University of Sheffield.
- Mangione, P. K., & Speth, T. (1998). The transition to elementary school: A framework for creating early childhood continuity through home, school, and community partnerships. The Elementary School Journal, 98, 381-397.
- Merriënboer, J. J. G. van (1997). Training Complex Cognitive Skills. Englewood Cliffs, NJ: Educational Technology Publications.
- Mooij, T. (2000). Screening children's entry characteristics in kindergarten. Early Child Development and Care, 165, 23-40.
- Mooij, T., & Smeets, E. (2001). Modeling and supporting ICT implementation in secondary schools. Computers & Education, 36, 265-281.
- Mooij, T., Terwel, J., & Huber, G. (2000). A social perspective on new learning. In R.-J. Simons, J. van der Linden, and T. Duffy (Eds.), New Learning (pp. 191-208). Dordrecht, The Netherlands: Kluwer.
- Pellegrini, A. D., & Boyd, B. (1993). The role of play in early childhood development and education: issues in definition and function. In B. Spodek (Ed.), Handbook of research on the education of young children (pp. 105-121). New York: MacMillan.
- Skinner, D., Bryant, D., Coffman, J., & Campbell, F. (1998). Creating risk and promise children's and teachers' coconstructions in the cultural world of kindergarten. The Elementary School Journal, 98, 297-310.
- Remillard, J. T. (2000). Can curriculum materials support teachers' learning? Two fourth-grade teachers' use of a new mathematics text. The Elementary School Journal, 100, 331-350.
- Sinko, M., & Lehtinen, E. (1999). The Challenges of ICT in Finnish Education. Jyväskylä, Finland: Atena.
- Tymms, P., Merrell, C., & Henderson, B. (2000). Baseline assessment and progress during the first three years at school. Educational Research and Evaluation, 6, 105-129.
- Walker, H. M., Kavanagh, K., Stiller, B., Golly, A., Severson, H. H., & Feil, E. G. (1998). First step to success: An early intervention approach for preventing school antisocial behavior. Journal of Emotional and Behavioral Disorders, 6 (2), 66-80.
- Wegerif, R., Mercer, N., & Dawes, L. (1998). Software design to support discussion in the primary curriculum. Journal of Computer Assisted Learning, 14, 199-211.
- Wilson, B. G. (1999). Evolution of learning technologies: From instructional design to performance support to network systems. Educational Technology, 39 (2), 32-35.

## Peer Online Discourse Analysis

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### Short Description

This session will analyze peer online discourse on a collaborative team problem solving assignment in a large college class, in an attempt to understand the group dynamics in online collaborative environments. Issues and problems associated with peer online collaboration and implications for the possible roles of instructors and instructional designers will be discussed.

### Abstract

*Collaborative learning has been gaining increased attention in the practice and research of education. As Vygotsky (1978) points out, social interactions play a very important role in learning. Research shows that learning to work with a small group can promote group learning as opposed to individual learning. (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999). Computer technologies, as scholars believe, can support collaborative learning and be beneficial to learners in many different ways (Harisim, 1990; Bonk and King, 1998; Lin et al, 1999; Schwartz et al, 1999). Various forms of Computer Supported Collaborative Learning (CSCL) have now been widely used as supplements to traditional classroom learning as well as in distance education (Bonk and King, 1998).*

*Research shows that learning in groups improves students' achievement of learning objectives. Some indicate that a facilitator will smooth the process of collaboration (Johnson et al, 1987; Hooper, 1992; Moore and Kearsley, 1996; Brandon & Hollingshead, 1999; Bernard et al, 2000). Advocates for peer-controlled collaboration claim that learners usually feel more comfortable discussing without the presence of the instructor. This may be explained by research which indicates that when participants have more active control of the learning process, learning increases (Jensen, 1996). This previous research lays a foundation for hypotheses about online peer collaboration using different types of moderators and strategies; however, there is a lack of empirical evidence for making strong recommendations. Which approach is more effective for group collaboration, the peer-controlled online collaboration forum or the structured and moderated online collaboration forum? This question is a difficult one to answer, but this study begins to answer the question by investigating the **quality** of peer online discourse. This study discusses possible activities to enhance web-based peer collaboration activities as well as the roles that instructors and instructional designers can take in the creation of effective online peer collaboration activities.*

*In this study, complete electronic discourse transcripts of college students in a collaborative problem solving assignment will be analyzed to measure the quality of peer online collaboration with the two different methods, to help understand the group dynamics and types and patterns of social interaction which occur online.*



## Introduction

Collaborative learning has been gaining increased attention in the practice and research of education. As Vygotsky (1978) points out, social interactions play a very important role in learning. Research shows that learning to work with a small group can facilitate group learning as opposed to individual learning. (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999)

Computer technologies, as demonstrated in research and practice, can support collaborative learning and be beneficial to learners in different ways (Harisim, 1990; Bonk and King, 1999). Computer technologies, for example, make collaborative learning achievable even when face-to-face communications are less accessible, and more importantly, they can be designed to support delayed reflection (Lin et al, 1999; Schwartz et al, 1999).

## Statement of the Problem

As computers and networking technologies are introduced into education, the form of education is changing dramatically. A variety of computer-supported education has been widely used to promote learning beyond the limits of geographic location and time. With technologies available today, learners can establish connections and contacts with instructors and peer learners beyond the traditional classroom. Computer Supported Collaborative Learning (CSCL) Tools, including online forums, facilitate learning by offering opportunities for interaction and collaboration. Online forums, as one of the most widely used CSCL tools, have been introduced to today's colleges to facilitate peer collaboration (Bonk and King, 1999).

In large classes, students often feel little attention to their individual needs, and may sometimes consequently feel isolated in the learning process. Active learning in large classes often occurs in group activities. This group collaboration has been shown to enhance learning (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999). Some research indicates that a facilitator will smooth the process of collaboration (Johnson et al, 1987; Hooper, 1992; Moore and Taylor, 1996). Advocates for peer-controlled collaboration claim that learners usually feel more comfortable discussing without the presence of the instructor. This may be explained by research that shows when participants have more active control of the learning process, learning increases (Jensen, 1996). This previous research lays a foundation for hypotheses about online peer collaboration using different types of moderators and strategies; however, there is a lack of empirical evidence for making strong recommendations. Which approach of peer online collaboration is more effective for group collaboration, the peer-controlled online collaboration forum or the structured and moderated online collaboration forum? Redundant with above, use one place or another, or re-word. This question is a difficult one to answer, but this study begins to answer the question by investigating the **quality** of peer online discourse and discusses possible activities to enhance web-based peer collaboration activities as well as the roles that instructors and instructional designers can take in the creation of effective online peer collaboration activities.

## Research Question

This study begins to consider the question of online peer collaboration structures by investigating the quality of peer online discourse. More specifically, the study intends to explore if there are differences in the quality of students' online collaboration in the two types of online collaborative forums, and tries to understand why such differences, if any, occur.

## Definition of Terms

In an attempt to alleviate any confusion due to the use of different terminology, relevant terms are defined based on how they are used in this study.

- Collaboration:

Mutual engagement of participants in a coordinated effort to reach a shared goal. Bruner (1991) defines collaboration as a process to complete tasks that cannot be fulfilled individually, or cannot be done efficiently otherwise. Mutual engagement includes joint efforts to develop a set of goals and directions; to share responsibilities; and to work together to achieve those goals, utilizing the expertise of each collaborator.

- Computer Supported Collaborative Learning (CSCL):

An learning method that implements information and communications technology to facilitate collaborative learning (Wasson, 1997, 1998).

- **Online forum:**  
An asynchronous electronic means for communication and collaboration, where participants can post and respond to messages and discuss and collaborate on the Internet.
- **Peer-controlled online forum:**  
A web-based bulletin board for peer learners to communicate with one another as they wish without moderation or any other active participation of the instructor.
- **Structured and moderated online forum:**  
A web-based bulletin board for peer learners to communicate and collaborate, where the instructor takes active responsibility to structure, scaffold and moderate the collaboration.
- **Problem solving:**  
“ In general, problem solving involves dealing with new and unfamiliar tasks or situations that present some obstacle, and relevant solution methods are not known. In Gagne’s conditions of learning, problem solving is the skill of recalling and applying a set of rules in the proper sequence to solve a problem. It is also referred to as higher-order rule learning” (Gredler, 1997, 364).

## **LITERATURE REVIEW**

### **Sociocultural Theory**

Vygotsky states that learning is a developmental process, and it occurs in social activities (Driscoll, 1994). One of Vygotsky’s most influential contributions is to analyze human psychological development from a social-cultural history method (Gredler, 1997). As Vygotsky notes that higher ordered, complex thinking is gradually developed through social interactions with others in the culture (Gredler, 1997).

Consistent with sociocultural theory, research shows that learning in groups improves students’ achievement in various learning objectives and some indicate that a role of facilitator will smooth the process of collaboration (Johnson et al, 1987; Hooper, 1992; Moore and Taylor, 1996). Research shows that successful group learning promotes higher order thinking (Blumenfeld et al, 1996).

As Vygotsky (1978) points out, the learning environment is critical, as people learn from people around them and are influenced by the culture of the learning context. According to Sociocultural theorists, people learn from mediations and scaffoldings, which are offered within one’s zone of proximal development (ZPD) from more capable peers or expert (Wertsch, 1985; Gredler, 1997; Bonk and King, 1999). Vygotsky defines ZPD, one of the key concepts in the sociocultural theory, as the distance between one’s independent competency and that obtained with assistance from the expert or in collaboration with more capable peers (Wertsch, 1985). Such a distance can be bridged by scaffolding, as external assistance is gradually reduced and the learner finally achieves independent competency in the task (Gredler, 1997). Research and scholarship also claim that computer supported collaborative learning environment can provide the Zone of Proximal Development (ZPD) (Salomon, Globerson and Guterman, 1989; Newman et al, 1993). In collaborative learning environment, learners’ ZPD can be reached and extended through communications and collaborations with peers and the instructor. Also the applications of computer technologies can help scaffold within learners’ Zone of Proximal Development in collaborative learning and therefore to promote learning outcomes.

### **Collaborative Learning**

Collaborative learning, consistent with sociocultural theory, is gaining more and more attention in education. Social interactions play an important role in learning (Vygotsky, 1978); in fact peer group work can have significant impact on varied learning outcomes (Jonassen et al, 1995; Berge and Collins 1995).

Very often, independent and individual learning can leave a learner passive and inactive. Vygotsky (1978) suggests that collaboration should help individuals make progress through their zone of proximal development by the activities in which they are engaged. Collaborations in peer group work increase engagement in the learning

process, and facilitate cognitive development. Collaborative learning changes the traditional teaching and learning practice; the instructor is no longer simply the “knowledge giver” or the center of power in the learning process. Instead, peer collaboration transformed traditional education to learner-centered, active “learning” activities. In peer collaboration, learners share knowledge, ideas and significant thinking, and therefore learn from one another and achieve goals that may not be obtained in isolated individual learning. Interpersonal communications enable and encourage learners to confer, reflect and help to develop meaningful learning (Johnson and Johnson, 1975; Clements and Nastasi, 1988).

As students are led to reflect upon and confront different ideas in peer collaborations, to provide meaningful feedback and support to one another, Cazden (1988) suggests that learners therefore can learn in a constructive way and benefit in cognitive development. Research shows that to learn and work with a small group can facilitate learning as opposed to individual learning (Johnson and Johnson, 1975; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Bruffee, 1999).

Collaborative learning environments provide a means to create more engaging and dynamic instructional settings. Research frequently shows that there are clear educational advantages to be derived from collaborative activities among students (Del Marie Rysavy and Sales, 1991; Slavin, 1992).

### **Computer Supported Collaborative Learning**

Computer technologies have further extended the formats of collaborative learning. Varied forms of Computer Supported Collaborative Learning (CSCL) have been adopted in education of both cognitive and affective domains (Clements and Nastasi, 1988; Hoopers, 1992; Repman, 1993; Jehng, 1997; Rada and Wang, 1998). Researcher (Dede, 1996) suggests that collaborative online learning should be integrated into higher education in the twenty first century.

Asynchronous online forums further facilitate self-paced and self-controlled learning and collaboration. Asynchronous online forums extend peer collaboration beyond the classroom, expand learners’ control over the time for collaboration, and increase the time available to read, to reflect and to reply to a message and formulate ideas in writing. Scholars (Vygotsky, 1978; Harasim, 1990) believe that the change from oral to verbal communication also contributes to learning effectiveness when learners have to concrete and articulate their thinking in writing. Asynchronous online forums also extend the time span for peer collaboration, making it more flexible. Learners can conduct the collaboration online as long as needed, and therefore can possibly improve in-depth investigation of the collaborative task (Harasim, 1990).

Virtual discourse in online forums can be stored and easily retrieved, and hence can facilitate delayed reflection, and is always open to review (Scardamalia and Bereiter, 1994; Blumenfeld, et al, 1996). Technologies also make participants’ thinking and reasoning visible (Lin et al, 1999). By requiring students to articulate their thinking, by facilitating comments and communications among learners, and by making it easy to view by thread, date or author, instructors can use asynchronous online forums to support delayed reflection. In addition, experiences indicate that some students that are not comfortable in classroom collaboration can be very active and engaged online, as there is no time restriction or competitions or interruption in the course of peer collaboration (Harasim, 1990). In asynchronous online collaborative environment, even less active learners can have the same time and opportunity to express themselves, without fear of being interrupted by more aggressive peers. In this sense, it can ensure equal opportunity in peer collaboration.

However, online collaboration forums do not simply make peer collaboration easier. First of all, asynchronous online collaboration is very different from face-to-face meetings. Participants communicate not in the real time but in the times at their individual choice. Yet the lack of non-verbal communication in an online forum makes misunderstanding and miscommunications less detectable, and thus requires higher communication competency in writing. Concerns for miscommunications can make participants more conscious and nervous about writing and diction in their online collaboration efforts. Second, learners may feel frustration with the technology itself. They may also feel like they are “talking to a vacuum” when no immediate response is available. In addition, consensus can be more time-consuming and is generally more difficult to achieve in online collaborations. Moreover, the quality of decision may be sacrificed to compromise delays caused in online collaboration (Harasim, 1990).

### **Scaffolding**

Closely related to the Zone of Proximal Development is scaffolding. Scaffolding refers to varied forms of external support and assistance to learners to complete a task that is beyond their individual, independent efforts

(Gredler, 1997; Bonk and Cunningham, 1999). Scaffolding is also a process to gradually reduce expert assistance as the learner gets more and more competent at the task in the learning process (Gredler, 1997). Scaffolding efforts are to provide necessary assistance and therefore to help learners achieve the zone of unknown gradually.

Scaffolds can be provided by different external agents, teachers, peer learners or supporting materials (Wertsch, 1985; Gredler, 1997; Bonk and King, 1999). With computer technologies, several design features can be embedded to provide scaffolds such as process display, process prompts, process models and reflective social discourse (Lin et al, 1999).

As suggested by research and scholarships, the role of facilitator can smooth the process of collaborative learning (Johnson et al, 1987; Hooper, 1992; Moore and Taylor, 1996). In collaborative learning environment, the role of instructor changes from the center of authority to a facilitator or co-conspirator ( Hamm and Adams, 1992; Flannery, 1994). In the peer collaborative learning environment, the instructor does not serve as an information giver, but rather, learners have more active control over the learning process. In addition, students need to be engaged in a very rich context to collaborate and develop higher order thinking (Bosworth and Hamilton, 1994). Similar to traditional classroom collaboration, in online collaborative learning environment, the instructor can take the role of a moderator and facilitator as needed in the course of peer online collaboration. Supports that the instructor can provide in the learning process include motivating students, monitoring and regulating learners performance, provoking reflection, modeling, moderations and scaffolding (Brown & Palinscar, 1989; Hamm and Adams, 1992; Bosworth and Hamilton, 1994; Brandon & Hollingshead, 1999; Jonassen, 1999).

Forms of scaffolding can include hinting, elaborating, guiding, questioning, prompting, probing, simplifying, or other similar learning supports (Bonk and Cunningham, 1999). The scaffolding efforts can also be classified as conceptual, metacognitive, procedural and strategic scaffolds, as Hannafin et al (1999) suggest. Conceptual scaffolds are to guides students in what to consider; metacognitive scaffolds are to guide how to think during learning process; procedural scaffolds are to guide students how to utilize the available features in the learning environment; strategic scaffolds are to provide macro-strategy initially or ongoing as needs or requests arise so to guide students in analyzing and approaching learning tasks or problem (Hannafin et al, 1999). The various scaffolds can be embedded in a well-designed computer supported collaborative learning environment and therefore to enhance learning and improve cognitive performance.

### **Structuring and Moderating Online Forums**

Some research documents that when participants have more active control over the learning process, learning increases (Jensen, 1996). Therefore less participation of the instructor may foster more active learning. But as some research indicates, participation in electronic discussion is often passive without instructor's participation. As Aviv and Golan (1998) report, most students in distance learning environments participate in electronic discussions by passively reading some peers' postings, and only responding to a few of others' messages, also very few students raise questions. Aviv and Golan (1998) also found that when preplanned, and focused, and students are led through the learning process, electronic discussions can lead to a highly successful learning experience. Scholars (e.g. Slavin, 1995) recommend the use of structured protocol to direct interactive discourse among peer learners so to reduce off-track and passive behaviors while ensuring opportunities for equal participation.

When shifting from the "center of authority" to "co-conspirator," the instructor needs to take substantial responsibilities in the course of collaborative learning in order to foster a learner-centered peer collaborative learning environment. As for students' participation in online collaborations, strong social skills and good group dynamics are essential to effective and productive learning outcomes. Group dynamics contribute to students' performance in collaborative learning and their satisfaction for the learning experience (Bosworth and Hamilton, 1994). Some participants' actions of "free riding" and "social loafing" and failure to contribution, however, can damage others' enthusiasm and motivation in the course of collaborative learning. In addition, the feeling of "talking in a vacuum" with online collaboration and other frustrations with technology and many other factors make online collaboration a challenge to many participants. Research indicates that even in learner-centered learning environment, as in online collaborative learning, moderations and structuring of the learning process are needed for successful learning experiences (Flannery, 1994). Online collaborations need to be well organized, facilitated, and moderated to be effective and successful (Hamm and Adams, 1992; Flannery, 1994).

### **Structuring**

Little research has been focused on how to structure peer online collaboration. In practice, peer collaborations are often structured by the learners themselves by chunking the group assignment into "detailed

division of labor” (Althausser and Matuga, 1999). In order to reduce “free riding” in teamwork, instructors also often structure the online peer collaborations by assigning a set of questions to each member of a group. Therefore every group member must participate by taking charge of the part of the task to which they are assigned. Such structuring, however, has drawbacks, as it tends to lead students to work on the group assignment in a cooperative way and thus miss the opportunity for collaborative learning. Individuals can execute their own part of the assignment without collaborative efforts from peers, and they may not contribute to other part of the assignment either.

Bosworth and Hamilton (1994) suggest that instructors create and develop requisite structure and process of the group to achieve better collaborative learning. Similarly, Slavin (1995) suggests using structured protocols to direct student interactions. Efforts of structuring peer online collaborations in this study are two fold, one is to structure group work, and the other is to structure the collaboration in online forums.

## **Moderation**

The importance of moderating peer collaborative learning has been recognized in practice and research (Harasim, 1990; Hamm and Adams, 1992; Bosworth, and Hamilton, 1994). Bernnard et al (2000) also suggest that instructors assume a facilitator’s role in an online collaborative learning environment. Strategies for online forum moderation include, but are not limited to the following: to maintain the discourse focused on the topic, to check team progress, to promote equal participation, to provide individual support as needed.

## **Research Design and Implementation**

The study was conducted in a large undergraduate introductory statistics course at a major university in the northeastern United States. As a required course by many majors at the university, this course included students from all majors and class standings. Forty-one groups, consisting of one hundred and forty eight students volunteered to participate in this study. All the participants were already experienced with teamwork in this course before the study began. Participants were given the opportunity to re-form teams of four or five each, based on their past team work experience with others in this course. The forty-one groups were then randomly assigned to either of the two types of forums (peer controlled or structured and moderated) and asked to collaborate on twelve problem solving scenarios in the online forums as a team assignment. As a result of the random assignment, twenty-one groups were using the peer-controlled online collaborative forum, and twenty groups were using the structured and moderated online forum. Each team was provided a private online forum, which only team members had access to. For each scenario, participants were asked to recommend an appropriate statistical technique to address the problem and provide justifications for the recommendation. The study took place in the last few weeks of the semester when students were extremely busy with finals, projects and exams for other course work, and participants had two weeks to work on the assignment before final submission. Before the study began, the participants had already experienced many technology-enhanced learning opportunities in this course, such as a course website, the password-protected web-based electronic textbook, online quizzes for individual assessment, and online forum for group and/or class bulletin board.

Teams assigned to the peer-controlled collaboration forums worked with their team members on the problem solving assignment without any intervention from the instructor or anyone else. Teams assigned to the structured and moderated collaboration forums, on the other hand, were closely monitored by the instructor and received scaffolding, moderation and structuring prompts from the instructor as needed.

## **Data Collection And Analysis**

All the electronic transcripts of each group’s discourse on the online forums were collected in a previous experimental study conducted by the lead researcher and analyzed with multiple-party discourse analysis principle applied. Since this research was interested in teams rather than individual behaviors, each team’s electronic postings on the private forum were saved and analyzed as one single unit.

Data were stored and organized in NVivo, a Qualitative Data Analysis (QDA) software. The researcher also wrote memos for each group to record general impression and important thoughts each time reading and/or coding the transcripts, and those memos were then analyzed together with the electronic transcripts.

The data analysis was carried out as an ongoing process as the research proceeded. when the teams were using the online forums for the problem solving assignment, the first author read the electronic transcripts as they became available everyday and wrote brief memos to record ideas and impressions constantly. Reading the transcripts and recording initial ideas as an ongoing process helped the researcher to understand the dynamic nature

of teamwork and online collaborations. It felt like the researcher were experiencing the team process, learning and observing collaboration real time as the participants did. It enabled the researcher to capture the dynamic nature of teamwork without meeting any of the participants in person or interrupting/disturbing the team dynamics.

Some teams used the online forums, which were originally designed to be synchronous communication tools, for real time team collaborations. They set up a time that all members logged on and conducted the collaboration as if in a real time face-to-face meeting. In those incidences, the lead researcher, when she happened to be online exploring those forums, or when she knew the meeting time from their previous communications, then observed the team's online collaboration as if in a real-time observation.<sup>13</sup> While reading the team dynamics, the lead researcher took notes as if in a synchronous observation, and those notes were also analyzed together with the original transcripts.

When the team online collaborative assignment was due, all teams' online discourse was saved as electronic transcripts. Those electronic transcripts, which were collected in a previous experimental study (Zhang, 2000; Zhang & Peck, 2001) and now analyzed for an alternative perspective on and deeper understanding of the original questions, could be considered as secondary data (Hinds, et al 1997, Szabo and Strang 1997). Researchers (e. g. Hinds et al, 1997, Sandelowski 1997, Szabo and Strang 1997, Thorne 1994) argue that secondary data analysis can be deployed to revisit existing theories and/or generate new knowledge. The memos the lead researcher took, either when observing team collaborations real time or when coding and re-coding, were primary data. Both primary data and secondary data were analyzed together in this study.

As the research question was particularly interested in comparison, which is a basis of discourse analysis (Lemke, 199?), discourse analysis principles were very appropriate as an attempt to understand the team interaction pattern. As researchers (e.g. Lemke,199?) believe that language written or spoken, as research data should be translated from the activity in which it originally functions to the activity in which we are analyzing it. Also human discourse is, by nature, highly contextual, online or in person, thus it was critical for the researchers to visit and re-visit the electronic transcripts frequently through the study. And the real time observations played an important role in helping the researchers understand the context of the collaborations when they happened and hence enabled the researchers to interpret the language and interactive rhetoric as close as we could.

## **Researchers identity**

The lead researcher was also the primary researcher of the study from which the electronic data was gathered so she understood the data collection process and the context in which it was generated. During the experimental study, where participants were first introduced to the online forum as a collaborative learning tool, the lead researcher was also working closely with the students and instructor of the course as the technical supporter and was actively involved in setting up the forums, facilitating re-grouping and provide resolving technical issues. Yet most of the contacts between the lead research and the participants were through email, the online forum or indirectly through the instructor. Since the experimental study only lasted for two weeks, lead researcher did not become to know any of the participants in person, nor did she become familiar with any of them. The physical and psychological distances, which were generated from the little personal knowledge and only electronic communications, served both good and bad for the research. On one hand, the distances enabled the researchers to be closely engaged with the data, the online discourse transcripts, while staying detained from the participants. Thus the researchers were able to study the groups with little personal bias on particular participants. Yet on the other hand, in the data analysis process, the researchers often felt the strong curiosity to get to know the participant in person as they came out vividly as live characters from their online discourse. Also the nature of the medium had limited the communication cues (Daft & Lengel, 1984; Fulk et al, 1990), and the researchers felt some personal contacts with the participants might have helped interpretation of the discourse, or might have led us to a more in-depth understanding of the group dynamics as well as the problem solving process.

We did line-by-line coding to generate initial ideas and categories and tired to discover the relationship among concepts, or nodes as referred to in NVivo. The researcher first coded five files line by line, using only free nodes to get a sense of the data. As inducted from the data, we noticed that the transcripts could be categorized into four major groups of codes, team process related, task related, media related and relationship related, which were referred to as tree nodes in NVivo. The four categories were also consistent with literature on teams in organizations

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<sup>13</sup> We think it *is* observation, which happened to be occurring online. Having obtained participants' consent, the lead researcher still felt facing the ethical issue of 'lurking' while observing the online collaborations.

(e.g. Guzzo & Dickson, 1996) and information and communication technology (e.g. Daft & Lengel, 1984; Fulk et al, 1990; Fulk, 1993; Gunawardena, 1995). So we re-organized most of the free nodes into the four major themes as tree nodes in NVivo, task-related, team process, relation related and media-related, each with extended nodes under it. In the coding process, we used the tree nodes to help categorize ideas and identify the team collaborative process and quality. In the coding and recoding process, we constantly needed to add, change or modify the nodes and their relationships as indicated in the tree nodes structure, since our interpretation and understanding of data was developing and merging throughout the process.

As the data indicated that the major theme was task-related, in the late stage of data analysis we started from a key node, interactive collaboration, which was identified as the most important node from task related tree node, and tried to figure out the possible relationships among the nodes. The researchers also used the concept mapping software, Inspiration 5 and the modeling feature embedded in Nvivo to untangle and present the relationship among the key nodes. A model of team discourse was developed later for each approach of the online collaborative forums.

Scholars (Lincoln & Guba, 1985; Moustakas, 1994; Stake, 1995; Creswell, 1998) suggest the application of various techniques to ensure the quality of qualitative research. We invited colleagues and peer researchers for review and debriefing throughout the research. In addition, the first author met with a colleague twice a week in the data analysis process to discuss and reflect upon the research process and to ask for an outsider's opinion on the interpretation and coding of the data. Also the researchers were constantly engaged in academic discourse with peers for alternative interpretation and representation of the data in lively discussions. The scholarly communications between the researchers and with peer researchers helped to validate and establish trustworthiness of the research. Also with the concept mapping and the QDA software, the researchers were able to constantly refine the coding and analysis through the research.

## Findings

A model was developed for each type of collaboration forum to represent the major findings of this study. (figure 1, figure 2 inserted here.) As indicated in the model, there are two major differences between the online discourses in the two types of forum, peer-controlled and structured and moderated. One was the presence of strategy that guide through the four major themes (i.e. task-related, interaction pattern, relationship-related and media-related). The other was the strength of interactive collaboration.

Discourse occurred in the structured and moderated forums started with a strategy, in the form of a proposal for or discussion of a strategy, which then generated shared agreement on how to process the problem solving assignment as a team. Such strategies often included two aspects, one about team processing, (which was reported in the models as interaction pattern, because the researchers decided that the two-week discourse was too short and not rich enough to determine the team processing pattern) and another for the team task. Many teams started with a clarification of membership, since they were re-forming a self-selected group, and started with questions, suggestions or statements on how to collaborate on this assignment.

Interactive collaboration as merged from the data was conducted through simple agreement, agreement with elaboration, question and answer, and disagreement. In forms of information seeking, asking/providing clarification, challenging other's ideas and further questions that led to active learning beyond the scope of the original task. Through interactive collaboration, participants experienced self-reflection and critique, made connections and comparisons with previous learning, and searched and utilized other resources. Such interactive collaborations did happen in both types of forum, yet it was evident that in the structured and moderated forums, groups had more intense and orderly interactive collaborations and did achieve active learning through the collaborative inquiries, while in peer-controlled forums groups often stayed with individual and/or fragmental reasoning and many left the forums without any interaction or collaborations. The one-way, individual reasoning, together with simple agreement without reflection or elaboration on it, fail to lead the teams experience real collaborative learning and thus lost opportunities for shared active learning. Simple agreement, which happened very often in the peer-controlled forums, indicated only shallow, superficial, interactive collaboration, if we considered it as collaborations at all.

Starting with a strategy, or the efforts to build some strategy in the early stage of the task also helped the teams to establish a mutually agreed interaction pattern with people taking the leadership role and organize the collaboration in a well-accepted fashion. Such efforts were evident in the structured and moderated forums and the interactions thus were more clearly organized and processed. Yet in the peer-controlled forums, teams either did not interact at all or did it in a more or less chaos or similar manner.

Closely related to the interaction pattern and task-related themes were the relationship-related issues as indicated in the data. Teams that showed mutual respect and provide support and encouragement to one another were also showing interaction patterns in an orderly manner, and had more frequent and in-depth interactions with one another. In peer-controlled forums, teams either went off-topic and spent a lot of time in the online forums on relationship-related issues or did not show any evidence at all on team member relationships.

Online forums at the time the data was collected were, and probably still are, a new medium for learning as well as communication. Part of the task-related and interaction patterns, as shown in the data, was about the team collaboration media. Teams chose different media to meet their needs for collaborations at different stage of team problem solving. Those choices varied from team to team. Yet it was clear to the researchers that the choice of medium that matched their needs was critical for the successful of team collaboration process and relationship-related issues.



# Courseware & Copyright: Who's Rights Are Right?

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*Penn State University*

## Short Description

This session addresses the difficult issues of balancing faculty and university rights and responsibilities regarding courseware and courseware modules developed as both commissioned and non-commissioned works. The ways in which this debate affect those who are engaged in a) building their own online courses for their universities; b) courseware development as consulting practice, and c) work for universities as faculty development web development experts will be addressed.

## Introduction

The application of the web to higher education has brought with it many new and, at moments, disturbing systemic impacts that significantly effect the work of instructional design faculty and instructional designers in higher education. On-line learning is a considerably different approach to higher education (Daniel, 1996; Gubernick & Ebeling, 1997; Hall, 1995; Chea, 2000) and creates important new challenges including what counts as digital courseware, how is courseware different from textbooks, who owns courses that are designed for online learning, under what circumstances, and who controls those courses into the future? Most of these questions have been dealt with substantially through a number of publications of policies for various institutions (University of Wisconsin, 1997; University of Pennsylvania, 1997; University of Texas System, 1998; University of Illinois, 1999; University of California, 1999; University System of Maryland, 2000; Penn State, 2000) and through a number of think tank reports (CETUS, 1997; AAU, 2001; Twigg, 2000; AAUP). While a good deal of work has already been accomplished examining courseware and copyright issues, none has linked these questions and policy discussions specifically to the work of instructional designers.

Thus this work is an extension of the work begun by many policy makers, administrators, lawyers, faculty members, and intellectual property scholars. Specifically, this paper will look at the potential impacts of a variety of copyright issues on the work that instructional designers do—particularly in the online educational development enterprise.

There are two primary roles that instructional designers hold in the university, as service professionals and as faculty. As instructional design professionals, the impact of policies, which may serve to encourage or discourage faculty participation in the creation of online courseware may have broad and sweeping impacts. For the first time since the inception of the field, courseware has brought the field of instructional design into the university administrations' radar screens. There is a sudden realization that in order to effectively move the traditional face-to-face course, which always required a human professor to make the pedagogical connection to extant materials (Hiltz & Wellman, 1997; Twigg, 2000) into the digital format requires these people called instructional designers. This has been a serious boon for our field, although at times there is a perception of our academic programs as being primarily service oriented rather than content oriented or research based-- a common problem for our field addressed by Heinich (1984). If policies are formulated which intimidate or worry faculty, there is likely to be a chilling effect, and a lack of interest in pursuing the creation of courseware on the part of faculty. Without the faculty, who are essentially the SME's or content providers, the instructional designers would certainly have a difficult time putting courses online. And some would question the ethicality of pursuing online learning in the absence of generalized faculty support.

In addition, instructional design faculty members are very interested in many questions associated with the new online higher education enterprise. It is an opportunity for consulting as well as research and scholarship. Here again if policies constructed by the institutions are narrow in their understanding of the work that instructional design faculty do in this regard, they could find themselves asking permission for each project from upper administration and constantly defending their work in an effort to show it is not a conflict of interest or infringement of narrowly construed intellectual property, courseware or copyright policies. This paper considers the specifications of three policies being considered at three institutions: Wisconsin, Madison, University of Texas, and Penn State as examples and as a contextualized basis for further discussion of the potential impacts of such policies on our work as instructional designers and instructional design faculty.

Instructional designers have been actively involved in design, development and delivery of online education, when building their own online courses for their universities; developing courseware as consulting practice, and/or serving as subject matter experts. Thus university courseware policies, both directly and indirectly, have significant impacts on instructional designers working in higher education. Considering the varied roles that instructional designers play in a university, we will be using university personnel in this paper to include faculty members, staff, and professionals engaged in courseware development. First we will examine some of the concerns that are raised initially as one considers courseware copyright policies, then we will turn our attention to more deeply understanding three contexts in which courseware copyright policies are either being considered or have recently been passed into campus legislation. Finally, we will reconsider the concerns that evolve from that deeper understanding of these new policies.

## **CONCERNS**

### **Academic Freedom**

Perhaps one of the most prevalent concerns voiced by faculty members in many subject areas is the extent to which the rules are somehow changing in this new technological world. Faculty are concerned that if courseware policies are passed, it may lead to infringements on academic freedom. These concerns actually take the form of several specific worries. First, faculty members are very concerned about their mobility as scholars, designers, and creators if university claims strong ownership and rights on courseware. If a faculty member leaves their home institution for another position, but their courses were online, to what extent will they be able to take their courses with them to their new place of employment? While it is clear that a faculty member takes their knowledge with them, and also that they would not be allowed to take the specific software solution designed for a given university with them, the questions of the gray areas are much more confusing. For example, let's suppose that a faculty member designs a course, an online course, with substantial support from their institution. They work with instructional designers, graphic artists, and software experts and create a really wonderful course that utilizes a very innovative *method* for delivering the instruction. The given method is the original idea of the faculty member, not the collaborative outcome of the work with instructional designers. The home institution could, under certain circumstances claim ownership over not only the specific course solution that was built utilizing their substantial resources, but also the innovation of the method itself, something that the faculty member originated and certainly planned to replicate perhaps in another medium at their new position.

### **Control**

Within the academic freedom area of concerns is another important general category—control. To what extent will the faculty member control the frequency, updating, and actual implementation of the course they have built. Here again, given certain policies, there is significant danger that courses will be under the control of administrators who may have more interest in profit than in fidelity to a given subject area. Faculty worry that their work may be changed without their approval, utilized without proper attribution, or offered far into the future under the direction of instructors without a significant commitment to the field being taught. Naturally, it is frightening to consider the possible replacement of professors with courseware without recognizing the creators, to use, modify, transfer or commercialize courseware without consultation with or permission from the original faculty authors (Farrell, 2001; Twigg, 2000; AAUP, 2001).

### **Defining Roles**

Clearly one of the fuzziest areas to many faculty are the understandings of the roles of faculty and support staff in the creation of online learning resources. In general, the administration at most institutions focus on the commitment of the faculty member to the institution, suggesting that it is a normal part of their job to create online learning materials and that they should not expect either ownership or additional pay, though they should be given the tools to enable the creation process. On the other hand, based on a history of textbooks and prior use of course materials in workshops, consulting, mini-courses, classes on tape etc, the faculty member understands the course as a basic unit owned by them. It is their content knowledge, their creation and has typically been their property in the past. While many institutions have long standing policies indicating that the syllabus for a given course is owned by the university, this is so rarely enforced in terms of mobile faculty or consulting usage that most faculty are unaware of such policies where they exist. In essence, many faculty see that the institution is there to serve them in their

quest to advance the knowledge in their given field, while the administrators see the faculty as there to serve the advancement of their home institution. The way that one interprets this conflict typically speaks clearly to the sorts of policies that are likely to result. Faculty members typically want very faculty-friendly policies, while administrators are looking for protection for the institution from competition in this new cyber-education world.

### **How to define substantial?**

Related to the understanding of roles is the subsequent understanding of the term “substantial”. This term is used extensively throughout the copyright literature and the resulting copyright policies. The use of substantial university facilities and/or personnel is often one of the most important or even determining factors in sorting out university ownership of courseware. Yet the concept of substantial is far from clearly defined. Partially because of the distinctions in roles discussed above, the concept of substantial resources is extraordinarily open to interpretation. The State University of Pennsylvania system, for example defines it as at least \$40,000 per project. This seems like perhaps the clearest definition of substantial that we have found in the literature. In general the term is defined in much more nebulous ways such as the “use” of instructional designers, graphic artists, working with a particular support arm of the university or the like. How much or how little is rarely as clearly defined as it has been at U Penn. However, even with this clear financial figure, still it is unclear precisely how that number is calculated. What “counts” and what doesn’t is not as clear as everyone would like. The U Wisconsin has a relatively detailed definition of “substantial” (See Table 1), yet the “extraordinary” use of computing resources remains a nebulous term and therefore unclear in terms of how it will be measured.

Given the varying roles the institutions and individual professors may play in the creation and development of courseware, it is not likely that a single principle of law can clearly allocate copyright interests in all cases (AAUP 1999). Generally the following instruments are deployed to address the courseware copyright issues: individual negotiations and signed agreements between individual university personnel and institutions; collective bargaining agreements between the university and personnel; and university copyright policies (Morgan, 2000). Many universities (e.g., University of Texas, University of Wisconsin, and Penn State University) have made efforts to develop a courseware policy to provide a framework on how to address courseware copyright. Generally three models of ownership are applicable, i.e. university ownership, university personnel ownership and joint ownership. The most common factors used to determine ownership include, but are not limited to the following: (1) the conditions under which the courseware is developed; (2) the scholarly nature of the product; (3) the commercial character of the work; and (4) the scope of employment.

### **Characteristics of AAU (1999) Model**

The current debate on whether to treat courseware as traditional textbook or as patentable innovations, as AAU (American Association of Universities) interprets (AAU, 2001), focuses only on the product, and AAU calls for a shift of attention from the product to the process when addressing courseware related copyright issues. The AAU model primarily represents the interests of the institution, or the administrators within the institution. AAU (1999) argues that courseware is a “collaborative creation” at a university. Based on this assumption, AAU further proposes that “the university should own the intellectual property that is created at the university by faculty, research staff, and scientists and with substantial aid of its facilities or its financial supports.” (AAU 1999).

Being very aware of how difficult it could be due to the complexity of new media products, AAU still proposes that generally applicable formulas should be available to allocate the sharing of returns on digital media products among individual faculty, departments, schools and the university.

For the products that do not rely on the university resources and not for use at the university (e.g. in courses), the university may not claim interests in them, yet the definition of “reliance on university resources” remains less than completely defined. Here is raised a particularly interesting set of questions. While it may be clear to many faculty that the use of \$40,000 or more of university resources justifies university ownership of courseware, if the faculty member does the work on his or her own time, then it would seem intuitively obvious that the university ought not to interfere with the use of these materials. This is particularly the case if the materials are not in substantial overlap with the faculty members’ duties at the university. However, university administrators are concerned about increases in competition for almost any online product that a faculty member at their institution may produce for a mass market. From the institution’s perspective, if people can gain access to famous faculty members online cheaply, or potentially cheaper than through their own university tuition and fees, then what could compel them to spend more? And then what protects the university under those circumstances from a substantial

loss of income because the faculty member is essentially competing against his or her own institution. We will revisit this question in more depth during the final section of this paper.

### Portability of intellectual property

AAU questions if courseware should be treated differently from patented discoveries, which belong to the university and are not portable with the faculty who invent them. Here we sense the blurred distinction between teaching and research, knowledge and products. The patent for an invention remains with the university who is granted ownership in the traditional custom, yet courseware is not a simple product, it is more likely to be a representation of knowledge and scholarly thinking, which is always expected to be continuously constructed through the journey of delivery as well as constant updates. It is potentially dangerous to view courseware as a one-time invention and thus to limit the portability of it. Also the importability, if defined in university courseware policy as suggested by AAU, will cause cautiousness among faculty members about their academic freedom, and is quite likely to reduce their motivation to design, develop, maintain, or update courseware.

### Characteristics of AAUP Model

If the AAU model represents the institutional perspective, then the AAUP (American Association of University Professors) model represents the faculty interests. AAUP (2001) proposes an informed allocation of rights between faculty and universities in forms of ownership, control, use and compensation. AAUP (2001) classifies the general projects into three categories: works that are properly considered “made for hire,” negotiated contractual transfer, and joint works as defined by the Copyright Act. AAUP (2001) further stresses that regardless of the ownership of the courseware, faculty members should be given rights in connection with future use of courseware that they have been part of in the creation and development. Not only through compensation, faculty should be given the right of “first refusal” in making new versions or at least of the right to be consulted in good faith on re-use and revisions (AAUP, 2001). Those points certainly voice faculty members’ concerns and are attempts to protect faculty members’ rights as scholars, researchers, authors, and creators while promoting development of courseware. For instructional designers and faculty members this is really important, particularly as regards quality control and academic freedom. The AAUP plan, while it is not as faculty-friendly as some models, certainly represents the interests of faculty and tends to encourage faculty to engage in the creation of online learning materials.

### Three Institutional Policies

We now turn our attention from models to specific policies. The policies of three institutions (University of Texas, Penn State, and the University of Wisconsin. We chose these three because they have all been recent negotiations and because we believe that they represent significantly different types of institutions. While all are relatively large public institutions, politically they are quite diverse in their histories and past policies.

University of Texas’ courseware policy has been recognized as the model for electronic course materials ownership (Farrell, 2001). And the American Association of University Professors uses University of Texas’ language as a template for its own policies and guidelines on the matter (AAUP, 2001). Thus the UT policy is perhaps the benchmark that other universities are typically considering as they create their own policies. Penn State after some lengthy debate in the faculty senate has just passed a courseware policy recently. And we think it is very telling to share their view and struggle with this issue. University of Wisconsin is historically a very politically progressive institution, so it would be interesting to see how they dealt with this in comparison to say PSU which is much more corporate in nature and does not have a history of progressive liberal policies.

In the following table we try to summarize the current university courseware policy at Penn State University, University of Texas System, and University of Wisconsin System.

TABLE 1

Ownership	Institution	Penn State University	University of Texas System	University of Wisconsin
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		(PSU)	(UTS)	System (UWS)
University ownership	Development conditions	<p>The university initiates the development as a normal duty or special project of a faculty member for which extra compensation is provided</p> <p>(applicable to both commissioned courseware and commissioned courseware modules)</p>	<p>Any of the following:</p> <p>Products are created within the scope of employment</p> <p>Using UTS time, facility or state financial support</p> <p>Commissioned by the university of a component institution, either as a contract or work for hire</p> <p>Research supported by federal funds or third party sponsorship</p>	<p>Condition 1: with “substantial” institutional support or involvement</p> <p>In such cases the university system may assert ownership or other property interests, which should be addressed through specific agreements with the authors and producers of the materials (University of Wisconsin System, 1997, p1)</p> <p>Condition 2: <i>As assigned duty of employment</i></p> <p>Condition 3: pursuant to a work-for-hire agreement</p>

	Allocation of other rights	<p>Generally, sale or use of courseware/ courseware modules in areas that substantially compete (how is it defined remains unclear) with PSU is not allowed without prior approval.</p> <p>For commissioned courseware: Written agreement between university personnel and the university prior to the project starts will establish the extent to which the materials may be used in derivative works published outside PSU and will also formalize the relationship with authors outside PSU, if any, and the procedure for the use of existing materials.</p> <p>If distributed outside of PSU, authors will receive 50% of royalty or other consideration received by the university</p> <p>For commissioned courseware modules: University give proper credit to author(s).</p>		<p>For Condition 1: Subject to a written agreement between U personnel and chief administrative officer of the institution involved to determine copyright and ownership</p> <p>For condition 2(assigned duty): U owns all rights, including copyrights and royalty and fees, unless a contrary agreement reached prior to the beginning of the project specifies otherwise.</p> <p>For condition 3 (work for hire): U receive all rights, including royalties and fees, and a written work-for-hire agreement shall be executed</p> <p>Fair payment shall be made to the author of the copyrightable instructional materials under the work-for-hire agreement</p>
Definition of substantial			<p>Released time from regularly assigned duties;</p> <p>direct investment of funds or staff;</p> <p>purchase of special equipments;</p> <p>use of multimedia production personnel and facilities;</p> <p>extraordinary use of computing resources</p> <p>(University of Wisconsin System, 1997, footnote 3)</p>	

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">U Personnel ownership</p>	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Development conditions</p>	<p>University personnel initiated, noncommissioned courseware and courseware modules which do not compete with any PSU programs</p> <p>Yet: the use of university resources to make university-personnel-owned courseware modules should use care to ensure that applicable copyright laws and policies are followed.</p> <p>No use of university resources, equipment, support staff, materials is allowed</p>	<p>General rule: author is the owner</p> <p>University of Texas System intellectual property policy permits faculty ownership of scholarly, artistic, literacy, musical and educational materials within the author's field of expertise.</p> <p>Product unrelated to university personnel's job responsibilities and no more than incidental use of UTS resources</p> <p>Invention that has been released to the inventor</p> <p>Intellectual property is embodied in a professional, faculty, researcher or student-authored scholarly, artistic, musical, literary or architectural work in the author's field of expertise</p>	<p>No or minimal University support or involvement</p> <p>"Minimal", as used in this policy, includes the use of university lab or equipment but does not include release time from regularly assigned duties. (University of Wisconsin System, 1997, footnote 2)</p> <p>it further defines "author", who has solely ownership for courseware produced under the above condition, as "creators of instructional materials...may include faculty, staff or students who, as a regular part of the instructional program, become participants in the creation of copyrightable materials" (University of Wisconsin System, 1997, footnote 4).</p>
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	Allocation of other rights	<p>Control and use of personnel initiated courseware modules at no or minimum cost remain with the author(s)</p> <p>University claims royalty-free nonexclusive right to use the personnel-initiated noncommissioned courseware in the university program</p> <p>Use of university-personnel-owned courseware in the university educational programs will only be allowed under the university's supervision.</p> <p>Courseware provided at no or minimum cost can be supervised at the department level.</p> <p>courseware modules provided at minimum cost can be supervised at the department level</p> <p>Sale or use of university-personnel-owned courseware that compete substantially with PSU is not allowed without prior university approval</p>	<p>In case of educational materials that involves significant institutional resources, UTS retains rights, for example, to use the work and recover its investment.</p> <p>University personnel owners must share benefits with the UTS from commercializing a UTS invention released to him/her; or if the work embodying the intellectual property required significant resources contribution from the UTS or s component to create or develop the intellectual property (parties should execute an agreement regarding sharing before the project starts).</p>	
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Jointly ownership	Development conditions		<p>Multimedia courseware and distance learning materials are very likely to be jointly developed and thus protected by joint ownership.</p> <p>When the university personnel's expression is added to a faculty member's contribution, it is then considered jointly-authored work, and owned by the university and faculty member.</p> <p>When substantial UTS resources are used in the development of a courseware, the university may claim joint ownership.</p>	
	Allocation of other rights		Written agreements among parties involved prior to the project starts is recommended to clarify the relationships and rights.	
External /extramural support		We only find policy regarding sponsored inventions(PSU, 2001) but nothing about sponsored courseware policy		Agreement with the extramural sponsor shall be considered in determining the copyright and ownership rights of the parties.
Claims on /interest in traditional course-related materials		Not specifically mentioned in current courseware policy yet no evidence that the university would claim for ownership for traditional course materials	Not specifically mentioned in current courseware policy yet no evidence that the university would claim for ownership for traditional course materials	Does not assert interests in materials resulted in traditional teaching, research and scholarly activities

<p>remarks</p>	<p>Conflict of interest/commitment is defined as: for personal financial gain</p>	<p>Written agreement among parties prior to the beginning of the project is recommended</p>	<p>Written agreement among parties prior to the beginning of a project is highly recommended to clarify rights and responsibilities of each party involved.</p> <p>responsible individuals are responsible for copyright-related clearance, waivers, agreement, etc.</p> <p>The policy encourages internal use and sharing based on agreements developed under this policy, and charges for internal use should be limited to actual, direct cost.</p> <p>Release to external distribution should be negotiated between the institution and the author.</p> <p>Revision or withdrawal: Shall not be altered or revised without consultation with the author</p> <p>When contrary to recommendation of the author, use, or authorization for use by others shall not be advertised or presented as the work of that author, except appropriate acknowledgement of the author's original production</p> <p>Author shall be offered opportunity for revision</p> <p>When considered for different uses than the original ones, author shall be consulted.</p>
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### **University of Texas System Courseware Policy**

University of Texas System (UTS)' standards automatically grant ownership of scholarly, electronic learning materials to authors who create them, reinforcing the traditional presumption for scholarly writings, books and teaching materials in universities.

As Georgia Harper, section manager for intellectual property, office of general counsel UTS points out (Farrell, 2001), "Faculty certainly own their course material in a traditional environment, and so to change it — to take away something they and we believe they own — would have precipitated an immense struggle." And the merit of UTS policy is that it recognizes the presumption of faculty ownership of work they create, and faculty members feel secured (Farrell, 2001). To keep a balance between the faculty members and the university, UTS policy recognizes faculty members as owner of software and other materials they create, and allows the university to reserve the right to recover cost if significant university resources have been used in the development process. Now, as a general rule, teaching materials created by faculty members, regardless of the medium, leave with the faculty creators if they leave the university (Farrell, 2001).

According to UTS policy, university personnel ownership is granted when courseware is unrelated to employee's job responsibilities AND is developed with no more than incidental use of system resources. Professional-, faculty-, researcher-, or student-authored scholarly, educational, artistic, musical, literacy or architectural work in the author's field of expertise, unless is for hire, or required to, or commissioned by the UT system, will be granted university personnel ownership as well. In case of substantial use of institutional resources, the university retains rights to use the work and recover its investment, from royalty, for example, and may claim joint ownership.

The UTS policy also points out that multimedia courseware products and distance learning materials, since are more than often jointly developed, are very likely to be jointly owned by the university personnel and the university.

### **Penn State University Courseware Policy**

After some lengthy debate, the faculty senate at PSU passed an administration-friendly policy which was promptly accepted without revision by the university president. The senate debate did raise many concerns for some faculty, but the bulk of faculty felt they would not be affected by the new policy and were willing to work with the administration to protect the institution from outside competition.

As the chair of the courseware copyright committee stated, one of the purposes of the efforts is to protect Penn State, a large traditional higher education institution from the commercial competitors such as the University of Phoenix.

The policy basically allows that the university has copyright ownership on online courses whenever the university initiates the development as a normal duty or special project of a faculty member for which extra compensation is provided.

The policy claims that for non-commissioned courseware, the university makes no claim to copyright ownership, however, it DOES claim the royalty-free, non-exclusive right to use the courseware in any university programs. Faculty have no right of first refusal. This part of the policy certainly does not incline faculty members to try to create non-commissioned online courses particularly in combination with the conflict of commitment clause discussed below.

In cases that the courseware is a full replacement of a university educational program, the use of such software is allowed only under university supervision and any courseware module that imposes a cost to students also requires university approval.

In order to protect the university from competition, faculty members are not allowed to create online courses for sale to private online institutions, corporations, workshops, or any other form which would in any way compete with Penn State. One important thing to understand about this part of the policy, called conflict of commitment clause, is that it also applies to areas far from the faculty members' duties to the university. In other words a Shakespearean scholar who chooses to create a course on gardening might run aground of this policy because Penn State, being a wholly comprehensive university, has an agricultural program that looks at gardening. Thus, if a faculty member decides, on their own, to create an online course, it may not in any way compete with PSU, if it does, it is not allowed without prior permission. So, a non-commissioned work is owned by the author, but PSU maintains royalty free non-exclusive right to utilize the materials and the faculty member is not likely to be able to sell the materials outside as it may be considered a conflict of commitment. In this case, ownership is not particularly advantageous to most faculty members which has caused some of them to chill to the idea of engaging in online course development.

In all cases written agreement signed by both the university and faculty members are recommended at the start of the project development.

### **University of Wisconsin System Courseware Policy**

The UWS policy, as stated in the background (University of Wisconsin System, 1997, p1), was developed to address the increased institutional involvement in development of copyrightable instructional materials. It was thus written with special focus on courseware developed with substantial support from the university,

University of Wisconsin System claims university ownership on courseware developed as a) work-for-hire or assigned duty or b) with substantial use of institutional support or involvement, and the university reserves all rights including royalty and fees for work-for-hire and assigned duty and rights allocations are subject to written agreement otherwise. UWS has provided a relatively detailed definition for “substantial” which helps to reduce conflict or ambiguous interpretation of the policy.

For courseware that is developed with no or minimal university support or involvement, university personnel ownership is granted. And there are no further specifications on allocations of rights for those courseware products.

For projects developed with external sponsorship, UWS specifically states that agreement with external sponsor shall be considered in determining the ownership and copyrights of all parties involved. Nothing is specified regarding joint ownership.

Interestingly, UWS is the only one among the three institutions we investigated that has specifically addressed the issues of responsibilities of the institution and university personnel, external distributions, revision and withdrawal. The policy specifies that responsible individuals for each project, who are assigned by sponsoring departments, are responsible for copyright-related clearance, waivers, and legal agreements. The policy encourages internal use and sharing based on agreements developed under this policy, and charges for internal use should be limited to actual, direct cost. External distributions may occur as direct rental, sale, or licensing by UWS or as commercial rental, sale or distribution by a third party under agreement for payment of royalties.

Release to external distribution should be negotiated between the institution and the author.

The faculty are clearly to be consulted whenever a course they authored is to be altered or revised. When contrary to recommendation of the author, use, or authorization for use by others shall not be advertised or presented as the work of that author, except appropriate acknowledgement of the author’s original production. Author shall be offered opportunity for revision unless he/she declines. When courseware is considered for uses different from the original ones, author shall be consulted. Thus these policies clearly have a high regard for the importance of faculty consultation and consequently academic freedom. The UWS policy shows respect to original authors of courseware, and ensures that authors shall be consulted for revision, alteration and different uses, regardless of ownership.

### **Discussion:**

As we outlined above, there are many critical issues associated with current policy making provisions for copyright and courseware ownership. In our view, from our perspective on the front lines of the Penn State debates, the copyright interests are at the nexus of faculty versus administration concerns. For the faculty member there is concern over academic freedom, future use, consulting restrictions, and even job security. For administrators, there is fear of competition, lost revenues, and even *their* own job security. This particular moment of conflict between faculty and administration is an important area for further exploration not only of the impact of specific copyright and courseware ownership issues and policies, but also of the basic working relationships between faculty and administrators—particularly administrators of distance education enterprises on traditional campuses.

What are the specific issues as they relate to the instructional designer? Certainly we have already hinted at one of the biggest concerns for service instructional designers who work with faculty to create online learning materials—that of disincentives for faculty and eventual extinguishment of new online courses to work on...concern over their own job security too. However, a different perspective on the issue might help instructional designers to support a pro-administration stance on copyright policies. If the institution is not able to recoup costs and make a profit on the online enterprise, their jobs are equally endangered. Perhaps the instructional designer can’t win either way they go, but they have seen that the most immediate concern is over whether or not faculty will continue to engage in activities that are not financially or institutionally rewarded at the same levels as competing activities such as research, scholarship or private consulting.

If we can separate ourselves from the specific personal interests of each of these groups for their own job and income concerns, we can begin to look at the problem a bit more holistically, perhaps even a bit more

systemically. All of the concerns voiced by all of the different parties are entirely legitimate. The question is what is most in alignment with the goals (historical or contemporary) of the institution of higher education. Advocates of online learning typically cite the importance of democratizing the university (CITE), opening access, and, in the case of land grant public institutions, the mission of outreach as primary goals for institutions of higher education. These are indeed important missions, however, they are very tentatively linked to the interests of administrators which are primarily around competition and income streams. While the rhetoric may focus on democracy, the policies do not. Policies that would focus on democratization would emphasize changes in incentive and reward systems within the university to more fully legitimize online learning development as important to the promotion and tenure process. Policies interested in furthering the reach of the university through online learning would not restrict faculty from offering courses online to any and all comers through whatever outlets were available and willing to invest the necessary resources. Instead, most administration policies assert the right of the institution to own the materials developed, essentially discouraging faculty from participating and lay out conflict of commitment clauses to minimize competition. This is borne of the self-interest of maintaining revenue streams within the institution. This may be seen by faculty as particularly egregious in the context of large salary increases taken by upper administrators within their home institutions.

On the other hand, the faculty members are rarely working out of purer motives, even from a systemic perspective. The rhetoric many faculty members use to forward the agenda of creating online courses for competing organizations is the importance of academic freedom. The stronger rhetoric is actually founded on the basic goal and mission of higher education. In this case, the mission that is emphasized is the advancement of knowledge throughout the world. The open access through MIT's recent agreement to put learning materials online free of charge is an interesting case of living this mission out. No one is making money off of that initiative unless it is through the good will that is spread by returning to a nobler mission for higher education. It is quite possible that such an open access initiative may engender significant public support for public institutions of higher education, making the entire enterprise far more relevant than it has been for many years. When the mission is seen as advancement of knowledge, and sharing of learning and information as widely as possible, non-compete clauses come up far short and administrator copyright policies appear to be more interested in furthering the goals of a corporation than an educational institution.

## References

American Association of University of University Professors (AAUP). Draft Statement on Copyright. Washington, D.C.: Author. Retrieved Oct. 20, 2001 from the World Wide Web: <http://www.aaup.org/spccopy.htm>

Association of American Universities (AAU) (2001). AAU Intellectual Property and New Media Technologies: a Framework for Policy Development at AAU Institutions. A Report to the AAU Digital and Intellectual Property Management Committee by the Intellectual Property Task Force. Retrieved Oct. 20, 2001 from the World Wide Web: <http://www.aau.edu/reports/IPReport.html>

Bulk, D. L. (1997). Ownership of Electronic Course Materials in Higher Education. CAUSE/EFFECT: A Practitioner's Journal about Managing and Using Information Resources on College and University Campuses. 20 (3), 13-18. Retrieved March 8, 2001 from the World Wide Web: <http://www.educause.edu/ir/library/html/cem9734.html>

Consortium for Educational Technology for University Systems(CETUS) (1997). Ownership of New Works at the University: Unbundling of Rights and the Pursuit of Higher Learning. Retrieved March 8, 2001 from the World Wide Web: <http://cet.us.org/ownership.pdf>

Council for Higher Education Accreditation (CHEA) (2000). Distance Learning in Higher Education (<http://www.chea.org/>)

Daniel, J. S. (1996). Mega-universities and knowledge media: Technology strategies for higher education. London: Kogan Page.

Farrell, J. M. (2001). Policy Seen as Model for E-Course Ownership: At the University of Texas, Faculty Members Own What They Put on the Web. Office.com. Retrieved on March. 8, 2001 from the World Wide Web: [http://www.office.com/global/0,2724,55-21830\\_2,FF.html](http://www.office.com/global/0,2724,55-21830_2,FF.html)

Gubernick, L. & Ebeling, A. (1997). "I got my degree through E-mail," Forbes, June 16, 1997.

Hall, J.W. (1995). The Revolution in electronic technology and the modern university: The convergence of means. *Educom Review*, 30 (4), 1-7.

Heinich, R. (1984). The Proper Study of Instructional Technology. *Educational Communication and Technology*, 32 (2), 67-87.

Hiltz, S.R. & Wellman, B. (1997). Asynchronous learning networks as a virtual classroom. *Communications of the ACM*, 40 (9) 44-49.

Morgan, G. (2000). Faculty Ownership and Control of Digital Course Materials. *Teaching With Technology Today Newsletter* 5(4), January 25, 2000.

Pennsylvania State University (2000). The university faculty senate agenda. Retrieved March 8, 2001 from the World Wide Web: <http://www.research.psu.edu/pu/ipreport.pdf>

----. (2001). Sponsored Programs Policy Book: Intellectual Property Policies and Procedures. Retrieved on Oct. 20, 2001 from the World Wide Web: <http://infoserv.rttonet.psu.edu/spa/ip.htm>

Penn State Senate Committee on Research(2001). Courseware Policy (Forensic). Presented at the University Faculty Senate Meeting on Feb. 27, 2001.

Twigg, C. (2000). Who Owns Online Courses and Course Materials? Troy, New York: Rensselaer Polytechnic Institute: Center for Academic Transformation. (<http://www.center.rpi.edu/PewSym/mono2.html>)

Seltzer, V. C. (1997). On the Horizon: the Intellectual Property Debate. *Almanac, University of Pennsylvania, Volume 44, Number* (available at: <http://www.upenn.edu/almanac/v44/n07/senate.html>)

University System of Maryland (2000). Draft Revised Policy on Intellectual Property. (<http://ipc.usmd.edu>).

University of Texas System (1998). U.T. System Intellectual Property Policy in Plain English. Retried March 8, 2001 from the World Wide Web: <http://www.utsystem.edu/ogc/intellectualproperty/ippol.htm>  
(Official policy available at: <http://www.utsystem.edu/ogc/intellectualproperty/2xii.htm>)

University of Wisconsin System, (1997). Financial and Administrative Polices: Copyrightable Instructional Materials Ownership, Use and Control (G27). Revised November 24, 1997. Retrieved on Oct. 20, 2001 from the World Wide Web: <http://www.uwsa.edu/fadmin/gapp/gapp27.htm>

# Creating “Technology Intensive” Courses Through Faculty Mentoring

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## Abstract

*The College of Education (COE) at the University of Hawaii (UH) has already begun to create an infrastructure to systematically infuse technology into its curriculum through a new designation of “Technology Intensive” courses. The primary goal of this project was to prepare future teachers to integrate technology into instruction through systematic reformation in the teacher preparation programs. To meet this goal, faculty members in the COE and their pre-service students are being mentored by graduate students to model technology integration. The newest generation of this project is referred to as “LEI Aloha,” which stands for Learning Enhancement through Innovation.*

## Project Need

The electronic revolution has created new means to present information with equipment such as digital video and multimedia authoring software. What is currently lacking, however, is the professional development and expertise in the usage of these tools in today's classrooms. Faison states that United States (US) Office of Technology Assessment (OTA) has concluded that the most direct and cost-effective way to train teachers about technology is through pre-service teacher education courses. The question then is how do we train faculty to be technology role models?

A technology needs assessment of the University of Hawaii at Manoa (UH) College of Education (COE) faculty was conducted by Ho, Sherry, Speitel, & Walton (1999) to find out how technology was being used to identify the training needs of faculty, and to provide recommendations for the future growth of technology applications in the COE. The survey was based on the guidelines of the National Council on Accreditation of Teacher Education (NCATE) and International Society for Technology in Education (ISTE) standards for technology within education.

Overall, it was found that there was a discrepancy between the use of technology for teaching and the use of technology for professional activities. Faculty and students commonly used email, word-processing, and on-line information for their scholarly work but much less frequently for teaching and learning.

It was interesting that students' use of technology mirrored that of faculty, but they used technology less frequently than faculty. This result demonstrates how important faculty are as role models to students. “After all, faculty model the use of technology applications in their courses. Also, faculty provide opportunities for students to use technology...”. Since students were rated lower on technology use, it suggests that faculty are still not providing adequate technological opportunities when designing their courses. This may be because the integration of technology into teaching is more difficult than personal use of technology.

This report confirmed the need for a continuing effort to solve this problem. Five years ago the authors developed such an effort in a program to provide professional development for a new designation of “technology intensive” courses. The program provides focuses primarily on technology workshops and one-on-one mentoring assistance for faculty.

## Standards and Guidelines

A 1996 pilot project was funded by the University to develop a general designation of “technology intensive” courses that could be used university-wide. The type of impact desired called for an expansive, long-term project thinking on the question of “what should our graduates know?” With the leadership of Fulford and Hines (1997), a committee of faculty members from a broad range of subject areas developed a set of technology intensive standards for the development of the courses.

The Technology Intensive Standards were derived from three sources: the UH General Education Standards, the United States Education Secretary's Commission on Achieving Necessary Skills (SCANS) Report, and the International Society for Technology in Education (ISTE) Standards for Basic Endorsement in Educational Computing and Technology Literacy.

The standards include six categories: ethics, operations, analysis, retrieval, application, and attitudes. The six categories cover 35 specific standards. The standards development team provided an explanation of each category's purpose.

The technology-intensive guidelines were established by Fulford and the committee (1997) to provide information for faculty on course development. The idea is that technology should help facilitate communication, problem solving, analysis, research, and presentation. However, the course subject matter would remain the same.

Faculty were expected to use at least one standard from each category since one course could not cover all the standards. The premise was that among the variety of courses students take, they would upon graduation have mastered these standards.

Faculty should model ethical standards as well as visual and instructional design techniques fundamental to learning with technology. Essential to all courses is the student use of technology including opportunities to create multi-media, web pages, videos, and electronic slide shows. Faculty are encouraged to discuss need for growth in technology with their students and to acknowledge issues of access, skill level, and anxiety.

### **Professional Development Workshops and Mentoring**

Faculty in the project have been provided with ongoing professional development to effectively integrate technology into their courses. Each year the project began with professional development workshops. These efforts received help from the graduate students in an Educational Technology Practicum. In each session, experienced faculty and teachers in kindergarten-12<sup>th</sup> (K-12) schools showed examples of how they were integrating technology into their courses. These were followed by specific demonstrations of hardware and software.

The next half of each session was devoted to hands-on practice with the technology. Faculty professional development has included topics such as: course design, visual design, electronic conferencing, web page design, multi-media and video production, electronic presentations and portfolios, technology ethics and copyright, assessment of technology projects, one computer classroom strategies, and online collaboration.

Once faculty members have attended the workshop sessions they are recruited to create technology intensive courses. Faculty who express interest for integrating technology into their courses are offered one-on-one assistance to facilitate this process. Faculty are paired graduate students from the Educational Technology Department who work for the project. Typically, the pairs will meet on a weekly basis over a semester. These sessions usually last about an hour and take place in the faculty member's office. The ultimate outcome of the sessions is a course proposal in which the faculty member outlines the ways in which they have redesigned a course to incorporate technology using the technology intensive standards. The proposal also describes the ways in which the faculty member is modeling technology use, the ways in which the students are using technology, the specific hardware and software being used and any future technology needs of the faculty member. In order for the students to be able to effectively mentor the faculty toward this goal, an instructional design approach is used to: (a) set goals for the professional development; (b) provide expertise in creating a revised curriculum especially with regard to the technology-intensive standards; and (c) assist in improving technical skills to help faculty members reach their technology integration goals.

The overseeing project faculty member and experienced graduate students pair student mentors with faculty members based upon the technology areas in which the faculty member has expressed interest and the specific areas of expertise of student mentors. Compatible schedules and preferred computer platforms such as Mac or PC are also important. Once the pairs have been established, the student mentor contacts the faculty member to assess their technology needs and levels of confidence and experience. A survey developed by previous graduate students is administered to determine interest and experience with various software applications and digital technologies such as video and still imaging.

Once the student mentor has determined the technology skill and confidence levels of the faculty member, an initial session is scheduled. At this session, the mentor and the faculty member discuss the content of the course to be redesigned and the vision and goals the faculty member has for redesigning the course to integrate technology. The mentor must be tactful with the faculty member to be encouraging and yet realistic as to what can be accomplished in one semester. The pair discuss their respective time schedules and the amount of time the professor has to dedicate to the redesign process. A letter of agreement provided by the mentor is signed by the faculty member stating that a) the faculty member acknowledges that the assistance will be provided throughout the semester, b) his or her involvement will include his or her participation and communication about the progress of the course, c) he or she will cooperate in the evaluation of the course by the grant project, and d) he or she agrees to be listed as a project participant on the project web site.



Student mentors need a number of skills in order to conduct one-on-one faculty mentoring. Not only do they have technology skills that they impart to the faculty but they also use instructional design knowledge to help the faculty member plan and organize the course to be redesigned. The goal of the mentoring is to assist faculty members to be independent, self-sufficient users of technology. To achieve this goal, students often need to know how to handle “sticky” situations. Examples of “sticky” situations include faculty members expecting the mentor to do the technology work for them, faculty members not completing work they have agreed to do in order for the sessions to proceed, chronic appointment cancellations, and faculty who are continually distracted by new media and stray off topic every week.

In order to conduct one-on-ones and to handle these situations, incoming graduate students who are hired to work one-on-one with faculty must be properly trained. Training students to be mentors is organized by an overseeing project faculty member and conducted by graduate students who have mentoring experience. These cross-training sessions, where students train each other, are held early in the semester.

The most fundamental of the cross-training sessions conducted is “how to conduct one-on-ones.” In this session trainees are introduced to a packet of materials created by project staff and students to assist both the faculty member and the student mentor with the one-on-one sessions. Included in the materials packet is the technology needs survey, the letter of agreement to be signed by the faculty participant and the student mentor, a copy of the technology intensive standards, and examples of the types of materials a mentor may want to use to keep their sessions organized and on track, such as lists of questions for faculty members, sample agendas and suggestions for how to keep sessions focused.

Essential features of this training session are role-playing and activities in which the new mentors are asked to come up with solutions to “sticky” situations. The first activity uses a series of written scenarios. New mentors are paired up and asked to read the scenarios, come up with solutions and provide and receive feedback on the solutions with the rest of the group. The second activity involves role-playing. Experienced graduate students act out skits of problematic one-on-one sessions and ask for feedback on various solutions. Feedback from new mentors has been positive about the role-playing and scenario problem solving. They report that it gives them a better idea of what to expect and how to handle a variety of situations. Experienced graduate students are asked to share their specific experiences conducting one-on-ones and provide helpful hints and practical tips for success.

Another cross training session conducted for incoming mentors is on the technology intensive standards. Experienced graduate students report that one of the most complicated parts of one-on-one mentoring is helping the faculty understand how to incorporate the standards into the redesigned course. The ETEC faculty member who headed the standards committee is usually asked to conduct this workshop. The faculty member gives a brief history of the standards project including how and why they were developed. She also goes over each standards category in detail and provides specific examples from previous proposals on how a standard was incorporated into a technology intensive course.

A third cross training session is provided to incoming student mentors on customer service. As representatives of the grant project and the Educational Technology Department providing a service to the college, the student mentors are expected to project professionalism, helpfulness and a positive attitude. This session goes over basics of positive communication, attentive listening, courtesy with fellow workers and customers as well as telephone behavior.

These cross-training sessions compliment the technology-based sessions conducted on a more informal basis by the students working for the project. The faculty member overseeing the one-on-ones and a graduate student organize cross-training sessions to be conducted by ETEC graduate students with specific knowledge in software or hardware. For example, ETEC graduate students have conducted cross-training on web design using DreamWeaver and Claris Home Page, advanced features of MS Word, how to use equipment such as data projectors, digital video and still cameras, effective web searching, digital video editing, WebCT and how to construct PowerPoint presentations.

The one-on-one sessions have provided individualized assistance in the same fashion as mentoring relationships. According to Archer (1999) many teachers are not confident in integrating technology into instruction. Based on project evaluations, mentoring faculty members through the one-on-one sessions has vastly improved confidence levels of the COE participants who have already created technology intensive courses.

NCATE (1999) suggests that mentoring and providing feedback is an effective method of professional development in technology integration. A train-the-trainer effort was implemented so those faculty members provided with professional development would also serve as mentors to K-12 faculty. Thus far, 17 general education faculty and 23 full-time COE faculty and 3 instructors have been involved in the project.

## **Response and Impact**

Faculty involved in the project have been positive in their feedback about the workshops and especially the one-on-one mentoring. Surveys and interviews reflect that the most popular form of course redesign assistance is the one-on-one session. Faculty report that while the workshops increase their technology skills, the one-on-ones meet their particular needs and are where they can truly concentrate on their own course redesign. The value of one-on-one assistance is perhaps most evident in the in-service teacher training program launched about the same time the technology intensive training program was being implemented in the College of Education. The Professional Diploma in Education (PDE) program, as a distance education program targeting teachers in rural areas on Oahu and neighbor islands, relies heavily on electronic media, particularly web-based delivery and email communication, and to a lesser degree interactive TV. It was largely due to one-on-one mentoring that the PDE faculty was able to overcome their initial difficulties with Web CT to launch the distance education program.

While the technology intensive mentoring has been highly successful, there are instances where one-on-one sessions have not been successful. Sometimes these cases arise due to mentor-faculty incompatibility. These instances provide valuable insight into program improvement. For instance, a faculty member purchased a complicated statistical software program and wanted to incorporate it in their personal research and statistics coursework. None of the student mentors were familiar with the program. A student mentor attempted to learn it but was also not familiar with statistics and felt that the amount of time it was taking to grasp the program was not well spent based on his limited progress. The faculty member was encouraged to consult with another professor versed in statistics and in this particular software. While most student mentors are familiar with both computer platforms, Macintosh and PC, a situation arose where hardware problems a faculty member was having with a Mac could not be solved by the student mentor who was more familiar with PCs. Situations like this are referred to other mentors or the Information and Technology Services Department on-campus.

Situations have also arisen where a faculty member has signed up for mentoring and had intentions of redesigning a course but then find they are too busy to add additional work to their load. Mentors may have been told this up-front or may have discovered it gradually through chronic postponing or cancellation of one-on-one sessions. Although faculty may be enthusiastic about redesigning their courses to be technology intensive, some may not be ready to completely redesign their courses. The expansion of the technology intensive project has addressed this challenge through a three-tiered approach to course redesign.

### **Project Expansion**

Although the project has been highly successful, only a third of the College of Education faculty that work with pre-service and in-service teachers have been trained. Two challenges facing the project group are how to recruit faculty members still reticent about using technology and how to provide a continuum of technology intensive courses throughout a COE student's schooling from the Community College level through to their field-based experiences. Continued federal funding from the US Department of Education's "Preparing Tomorrow's Teachers to Use Technology" program (PT3) has allowed the project to expand to meet these needs. The newest project (PT3) is referred to as "LEI Aloha" - Learning Enhancement through Innovation.

To meet the challenge of reluctant faculty, the LEI Aloha staff has developed a three-tiered approach to support the needs of teacher education courses.

### **Technology Intensive Courses:**

These courses follow the Technology Intensive Standards and Guidelines to improve technology literacy while continuing to emphasize course content. Students have a high level of involvement using technology, while faculty meet standards as exemplary role models using technology. In this process faculty need assistance in rethinking and redesigning their courses to integrate technology. They will have to revise course objectives, create new strategies and activities, locate and create new media, and develop alternative assessments.

### **Technology Applied Courses:**

These courses add the use of technology to the current course structure encouraging students to use technology resources in their research, communication, and presentations. The faculty member demonstrates and uses technology in the presentation of course content and communicates with students electronically. Faculty need help to become familiar with and use the multitude of alternatives that technology provides.

### **Technology Enhanced Courses:**

In these courses, the faculty member demonstrates and uses technology in the presentation of course content and communicates with students electronically. Faculty need to become proficient with redesigning their course presentations and using electronic communications.

To meet the second challenge of a continuum of technology intensive courses throughout a COE student's schooling, the project has expanded its mission to include Community College faculty. A majority of COE students have taken courses prerequisite to the COE at the Community Colleges. For many students, Community College faculty members provide the introduction to a college career and have a great influence on how students begin to shape their view of the teaching and learning environment. LEI Aloha is currently working with each of the seven community college campuses of the UH system to create technology intensive courses at all the campuses.

While the first components of the educational continuum are the community college and COE faculty, the final component are K-12 teachers who serve as mentors to students in their field experiences. These teachers play a vital role at a critical time in students' careers. Hinnant (1997) states that "the elements most crucial to the successful integration of technologies into teaching are teachers and their ability to use all their skills to inspire, motivate, challenge, and enrich their students (p. 1)". In these field experiences, students see first-hand whether and how technology can be integrated into the K-12 school environment. Positive role models are crucial at this juncture.

The LEI Aloha project is developing a series of web-based technology intensive teacher education courses. These courses are being offered in conjunction with a technology intensive sabbatical opportunity for K-12 teachers. The program will train in-service teachers to be technology mentors to pre-service teachers completing their field-based, student teaching requirements.

This project has been designed to create a broad ranging impact. It is based on the concept of mentoring and training-the-trainer to integrate technology. COE students are expected to become teachers who will provide their own students with the benefits of their knowledge. This will create a multiplier effect so that in just a few years, including the students of students, thousands of students will be affected.

## References

- Archer, J. (1999). Teachers suggest the need for better training. *Education Week*, [Online]. 18(21), 12. Available: <http://www.edweek.org/ew/vol-18/21nces.h18> [1999, May 1].
- Faison, C. (1996). Modeling instructional technology use in teacher preparation: Why we can't wait. *Educational Technology*, 36, (5), 57-59.
- Fulford, C. P., & Hines, M. E. (Eds.). (1997). *Technology Intensive Standards*. [online] Honolulu: University of Hawaii at Manoa, College of Education. Available: <http://www.hawaii.edu/ti>
- Fulford, C. P. (Ed.). (1997). University of Hawaii *Technology Intensive Courses, Curriculum Development Guidelines*: [online] Honolulu: University of Hawaii at Manoa, College of Education. Available: <http://www.hawaii.edu/ti>
- Hinnant, E. (1997). Strategies for the integration of technology into teacher education programs. *Technology Tools for Today's Campuses*. Available online: <http://horizon.unc.edu/projects/monograph/CD/>
- Ho, C., Sherry, A., Speitel, T., & Walton, F. (1999). *Educational Technology Use in the College of Education 1995-1999*. Honolulu: University of Hawaii at Manoa, College of Education.
- National Council for Accreditation of Teacher Education (1999). *Teacher quality: A report on the preparation and qualifications of public school teachers*. [Online]. Available: <http://www.nces.ed.gov> [1999, May 1].

# **Trek 21: Building Teachers' Capacity To Develop IT-Integrated Units With Student Engagement**

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## **Abstract**

*Trek 21 is a 3-year PT3 implementation grant from the United States Department of Education designed to build the capacity in teacher educators (teacher education faculty, Professional Development School faculty, pre-service interns) to integrate technology into their teaching. The goal of Trek 21 is to prepare educators to use and integrate instructional technologies (ITs) for teaching and learning. This paper discusses shifts in the development between year one and year two of teachers' web-based instructional units, with a focus on the degree to which year two units feature greater student engagement using networked technologies. Through a detailed discussion of project events and participant outcomes, strategies of the Trek 21 Model of Professional Development process are illustrated.*

## **Introduction**

The National Commission on Teaching and America's Future (1996) asserts that pre-service teacher education has the potential for the greatest influence in enhancing the learning opportunities of children. The report goes on to state that excellent pre-service teacher education requires bringing together the contexts of schools with the preparation of teachers. This preparation must be adequate and sustained in the professional practice of teachers.

Current instructional technologies offer students and teachers access to information and multiple modes of knowledge construction. By design, these new technologies make this method of knowledge construction largely individualistic and demand changes in teaching and learning environments so as to effectively integrate them into the instructional process. It is essential for new teachers (pre-service) to develop new perspectives on instructional design and new instructional technology skills within settings and environments in which these approaches are modeled. Students exiting teacher preparation programs must have acquired the ability to integrate new and future instructional technologies, and must have gained the skills necessary to adjust to teaching environments where limited technology infrastructure and capacity exist.

## **Preparing Tomorrow's Teachers to Use Technology (PT3) and Trek 21**

PT3 is an initiative of the United States Department of Education. Grants from the PT3 Initiative provide funding for innovative programs to develop technologically proficient educators who are well prepared to meet the needs of 21<sup>st</sup> century learners. "Trek 21: Educating Teachers as Agents of Technological Change" is a 3-year PT3 implementation grant from the U. S. Department of Education designed to prepare educators involved in West Virginia University's five-year teacher preparation program to integrate instructional technologies (ITs) into their teaching. The grant was awarded to the College of Human Resources and Education at West Virginia University (WVU) in 1999.

The Trek 21 model of teacher professional development includes host teachers in West Virginia University's Professional Development Schools (PDS), faculty from WVU's College of Human Resources and Education (HR&E), and student interns in their fifth year of the teacher preparation program. Trek 21 looks to impart lasting change in the culture of teacher practice. To help accomplish this change, the design of the Trek 21 model includes an annual cycle of professional development events: Summer Institutes for WVU faculty (seven days) and PDS teachers (three weeks), school site visits, mini conferences, and continuity meetings in the fall and spring.

## **Project Design**

The Trek 21 model is an annual cycle of events sequenced in such a manner so as to ensure long-term adoption of new practice, continuous support and feedback, and sustainability beyond the project.

### **Summer institutes**

A seven-day technology integration summer institute for university faculty and a three-week technology integration summer institute for PDS host teachers begins each year of the Trek 21 project cycle. These Institutes address genres of instructional technology applications (Harris, 1998), target technical training, and prepare instructional technology materials and resources necessary for immediate integration into classroom instruction. The final outcome is a teacher-developed, web-based instructional unit, which is implemented in the fall by the teacher in collaboration with a pre-service student intern.

### **Continuity meetings/site visits**

Following the summer institutes, Trek 21 holds continuity meetings with PDS faculty once each semester (fall and spring) to address issues related to the successful integration of instructional technologies at their location. School site visits occur throughout the year to provide continued support and gather data on unit implementation and local concerns.

### **Mini conferences**

Scheduled to occur twice each academic year, a mini-conference is held in partnership with West Virginia's "Technology, Teacher Education, Tomorrow" (T3) non-profit organization whose mission is to share best practices, receive technology enhancement training, and deliver presentations of activities related to the integration of instructional technologies. These conferences serve as our opportunity for state-wide dissemination of Trek 21 research results and presentation by participants of best practice where the integration of ITs is central.

### **Summary of Year One Events and Outcomes**

Participants for the first year included 47 PDS teachers who supervised pre-service interns during the fall semester. Of the 47 teachers, 17 were elementary school teachers, 19 were middle school teachers, and 11 were high school teachers. These teachers attended one of three summer institutes, each lasting three weeks. The Trek 21 Professional Development process for year one has been examined along multiple foci and reported (Adams, Dunham, Wells, & Shambaugh, 2001). Initial findings profiled K-12 participants as preferring a teacher-centered approach, providing minimal written details in lesson plans, and depicting themselves as low-level computer users with minimal integration levels of instructional technology. Analysis of lessons submitted by teachers at the beginning of the PDS Summer Institutes revealed 30% (14) of the teachers had a complete lesson(s), 32% (15) had some lesson plan features, and 38% (18) did not have a lesson plan.

An externally developed rubric guided the evaluation of participants' units, which resulted in an initial low percentage of posted teacher units. Following subsequent revisions during the fall continuity meeting, all teachers' units were posted to the Trek 21 web site. The web-based units were typically structured as teacher sites, with a limited number distinguishing between teacher and student activity. During year one, not enough emphasis was placed on the development of student-centered units and, as a result, learning activities were frequently depicted in lessons using traditional teacher-centered approaches. Although some ITs were integrated, particularly chat rooms and web boards, initially the units lacked the procedural details needed in order for other teachers and students to utilize them as the participants intended.

The most frequent learning strategies employed by teachers in their units involved a) problem solving using information retrieval and desktop publishing technologies, b) concept scaffolding with PowerPoint presentations and the Internet, and c) discovery learning through information retrieval and Internet searches. IT applications most utilized by teachers were presentations (32 activities), information retrieval (29), and Internet searches (17).

Final evaluations of teachers' web-based units indicated web design was an area that needed to be more fully addressed early in the development process. The most frequently occurring web design issues were: providing needed structure for the learning activities and information to communicate the overall intent, giving individual lessons descriptive titles, reducing scrollable text, documenting individual lessons on separate pages, reducing animated GIFs, improving background/text contrast, addressing web browser differences, providing appropriate

navigation and consistent use of navigation icons. Addressing these issues with teachers earlier in the development of their web units would provide the design and software foundation they needed to design well from the start.

The first year of professional development with PDS teachers revealed the need to provide teachers with a clearer picture of the overall intent of their web-based unit. For some participants, translating what they currently do in the classroom into web-based student-centered activities was a major shift. Feedback from the summer 2001 institutes indicated that providing greater clarity in our expectations of teachers, their obligations and responsibilities, would markedly improve the instructional outcomes of the project. Furthermore, year one findings indicated that by more clearly defining terms such as “lesson” and “unit”, incorporating strong examples of lesson templates, and providing consistency between the evaluation tools and instructional strategies employed, the professional development process would improve.

The importance of sufficient staff, proper facilities, and ample time is well understood. During the Trek 21 professional development process teachers expressed the need for as much time as possible for unit development. In addition year one feedback revealed that during the development time teachers require both consistently available technical assistance and sufficient pedagogical expertise as it relates to the instructional technologies integrated. This demand for both technical and instructional expertise presented a significant staffing challenge during year one institutes.

### **Year Two Design Changes**

Based on year two experiences, design changes were implemented to address specific preparation and training areas in need of improvement. Improvements such as clearly conveyed expectations, using common terminology understood by all participants, and indicating that units would consist of a minimum of five lessons enabled teachers to plan well for the institute. Their planning was also improved by asking them to submit units they had taught many times before, they felt very comfortable with, and that they would be teaching in the fall.

Re-designed unit/lesson templates provided participants with a consistent structure and common terminology upon which all their units could be developed and evaluated. The significance of the re-designed templates was the way they guided teachers toward separation of student and teacher activities, helping to emphasize the goal of creating student-centered lessons. As a result, prior to arriving at the summer institute most of the participants’ units were pedagogically complete and more ready for instructional technology integration. To address some of the web design issues found to be problematic in year one, participants were encouraged to begin their web page development using Trek 21 pre-designed web page templates. These web page templates included invisible tables, and contained consistent design and navigation features that enabled participants to concentrate on the application of instructional technologies rather than web page design. Participants were evaluated using a detailed, internally developed rubric that aligned directly with requirements designed into the unit/lesson and web page templates they all used when submitting application.

The evaluation of year one institutes identified the need for classroom expertise during training, which led to the incorporation of prior teacher participants as Instructional Leaders (ILs) as part of the Trek 21 Professional Development process. The Instructional Leaders served as master teachers to help ground the summer institutes by assisting new project participants with pedagogical issues, and by providing them with details on how to incorporate the three genres of instructional technology known to promote student engagement (Harris, 1998). The presence of Instructional Leaders allowed other Trek 21 personnel to focus on technical support, and resulted in the inclusion of additional (optional) breakout sessions to meet the diverse needs of novice, intermediate, and expert participants.

The Trek 21 cycle of events includes fall and spring continuity meetings and informal site visits in an effort to provide opportunities for further skill development and technical support. Each continuity meeting offers a full day of development time for teachers to revise their units with the convenience of a support staff readily available to provide assistance. The arrangement of informal site visits throughout the year allows Trek 21 staff members to visit each school for follow-up sessions with participants, assisting participants with problems and becoming familiar with their classroom environment. Additionally, selected project participants and Trek 21 staff members serve as part of a Trek 21 Leadership and Planning Committee, which reflect on prior institute processes and offer suggestions for revision.

### **Summary of Year Two Events and Outcomes**

Participants in year two consisted of 27 teachers selected from the Professional Development Schools within the five West Virginia counties included in the Trek 21 project. This group was comprised of two preschool teachers, 17 elementary school teachers, four middle school teachers, and four high school teachers. These teachers

attended one three-week long Summer Institute. Information collected from a self-reporting survey indicated that the participants' technological skill levels varied from novice computer users to expert computer users.

Random sweeps and select comprehensive evaluations of the pre- and post-institute lessons illustrated the extent of student engagement in units. Although teachers' objectives and methods of assessment were not changed by technology integration, modifications were apparent when comparisons were made between pre- and post-institute lessons. Active student engagement in instructional procedures, instructional strategies, and integration of instructional technologies increased significantly in post-institute units, reflecting an increase in student-centered lesson design. For example, active student engagement included overt responses to instructional prompts such as sequencing cards, responding verbally in writing, retrieving information from a web site, and participating in discussion. Units developed during the summer 2001 institute clearly indicate the development of learner-centered units where student engagement was encouraged via the application of instructional technologies. Evidence of changes to instructional procedures included the existence of a motivating introduction, review information, new content, guided practice, independent practice, closure, and extensions. Changes to instructional procedures also included active student participation in procedures for student-centered activities located within teachers' units. Indicators of change in instructional strategies took the form of advanced organizers, whole group instruction, peer-mediated instruction, group discussion, active responding, problem-solving, research, inquiry, hands-on instruction, manipulatives, dramatic representation, journaling or writing, student presentations, or teacher demonstrations. Most participants included detailed information on the unit web pages on how to apply the instructional strategies in order to promote student engagement in the unit. Similarly, improvements in IT integrations involved extensions to activities such as Computer Aided Instruction drill-and-practice, simulation, educational games, word processing, information retrieval, internet access, e-mail, bulletin boards, listservs, authoring, multimedia development, desktop publishing, electronic presentations, video development, open lab access, or web page development. Overall, instructional technologies integrated by teachers provided a variety of avenues that promoted student engagement and participation in unit lessons.

In addition to meeting the need for greater assistance with project participants during the institute, Instructional Leaders guided participants on approaches to effective student engagement and the enhancement of teaching and learning via instructional technology. Because sufficient staff and facilities were available, participants were afforded flexible technical training whereby they could select individual IT training sessions based on integration potential within their unit lessons. By and large, Trek 21 participation resulted in unit modifications by teachers that unmistakably reflected strong student-centered lessons.

### **Implications for Year Three**

Based on the overall results from years one and two, minor refinements will be incorporated into the design of year three to improve the Trek 21 Professional Development process. These refinements include clearer benchmarks pinpointed throughout the institute, perhaps in the form of a checklist, so participants can manage the amount of time spent on each section appropriately. Minor revisions to project documents such as the evaluation rubric and the unit/lesson templates will provide more precise guidelines for development. By offering concise directions and consistent expectations for all personnel involved in the project, participants will be more prepared to create web-based instructional units that integrate instructional technologies appropriately for student engagement.

Implications for year three focus on expanding the number of ITs by offering additional (optional) breakout sessions. During the first two days of the institute, exemplars will be identified that better illustrate the educational purpose of instructional technologies that will be offered throughout the institute. Teachers will be encouraged to choose from a pedagogical standpoint the instructional technologies they want to learn and integrate into their lessons. This will allow the participants to set their own limits on the new knowledge gained throughout the institute, so they are not overwhelmed with new possibilities.

### **Conclusions**

The design of professional development with instructional technology as a focus is complex and requires clear guidelines, continual communication, and flexibility to meet individual teacher needs. The existence of clear instructions, consistent objectives, and defined expectations contribute to the overall success, particularly in the area of active student engagement. Factors such as collaboration with instructional leaders, the development of a Leadership and Planning Committee, and the use of an evaluation rubric by external reviewers have all led to the specification of clear and distinct roles and appropriate support mechanisms for project participants. Requiring

teachers to submit a unit with a minimum of five related lessons prior to the institute allowed us to begin the institute with illustrations and demonstrations of appropriate student engagement on unit web pages.

Results from the Trek 21 model of Professional Development clearly indicate an effective process for the development of learner-centered units facilitated through the integration and application of instructional technologies. Preliminary findings suggest that the implementation of Trek 21 participants' units will enhance student engagement in the instructional strategies, procedures, and integration of instructional technologies.

## References

Adams, L., Dunham, T., Wells, J., & Shambaugh, N. (2001) Trek 21 – A PT3 Grant to help teachers design engaging learning environments. Proceedings of the 2001 SITE Conference. Orlando, FL: Society for Information Technology & Teacher Education.

Harris, J. (1998). Virtual Architecture: Designing and Directing Curriculum-based Telecomputing. Eugene, OR: International Society for Technology in Education (ISTE)

National Commission on Teaching and America's Future (1996). What Matters Most: Teaching for America's Future. Retrieved November 2, 2001, from <http://www.nctaf.org/publications/index.html>.



# Individualized Instruction: An Integrated Approach

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## Abstract

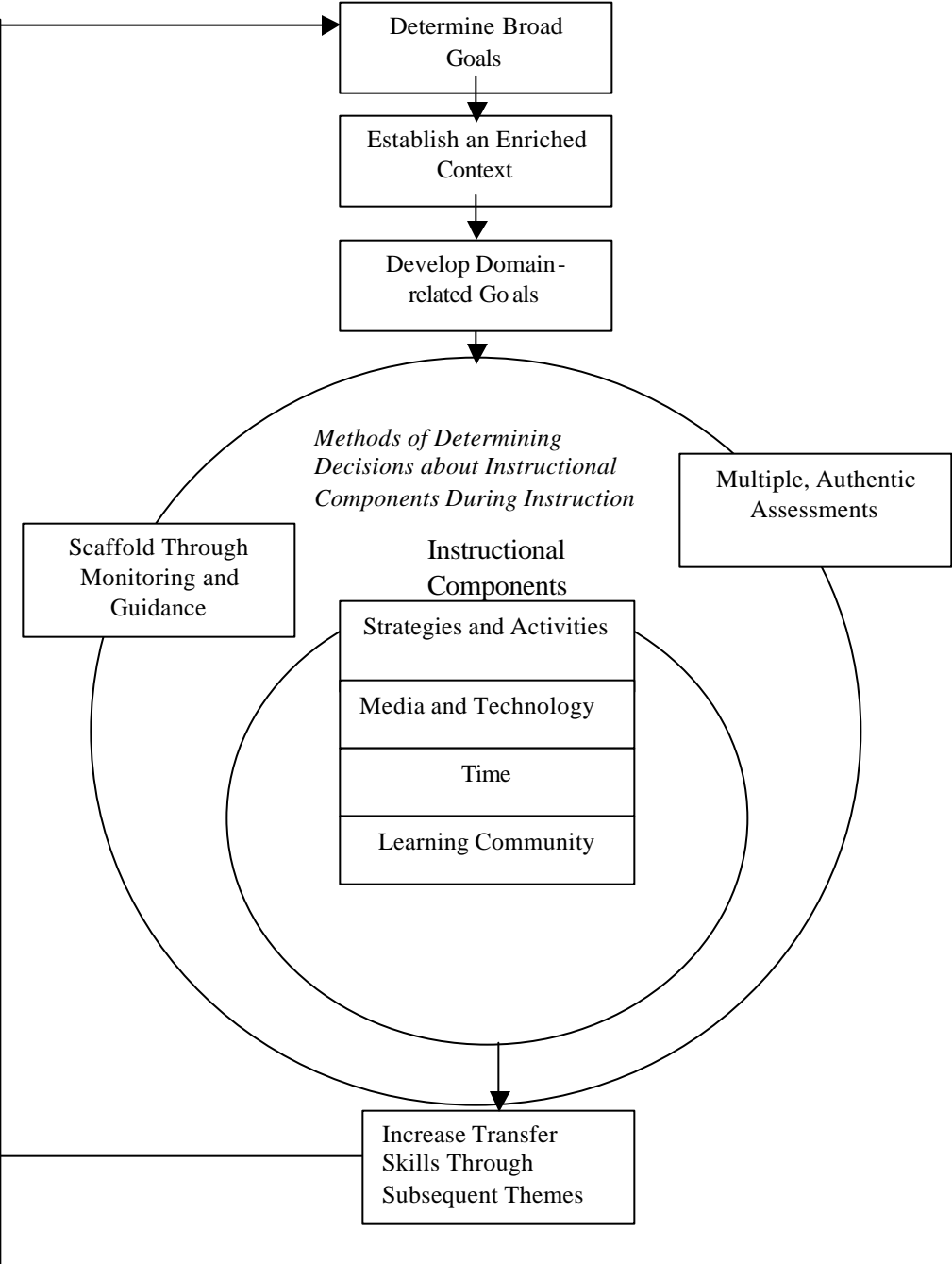
*To prepare diverse learners for various roles in life, teachers should develop contextualized learning environments that enable students to develop individual skills while contributing to the knowledge of the classroom community. This is accomplished by integrating various subject matter domains with interdisciplinary themes that incorporate real-life roles and contexts. This paper provides a framework for designing and implementing integrated units that address the needs of all students.*

## Introduction

As K-12 classrooms continue to diversify, it becomes increasingly important that teachers structure learning experiences to meet the individual needs of all students. Many students cope with learning and emotional disabilities, economic challenges, and limited English proficiency. Instruction must be designed to engage such students while appealing to multiple learning styles and those who are gifted. Instruction is more meaningful for students as they progress through material that is presented in an integrated, individualized manner. The challenge is to promote learning and inclusiveness by engaging and scaffolding students with varying abilities. This is accomplished through thematic, integrated lessons that utilize various media and technologies. Literature on learning theories informs the development of such student-centered environments. Experts in the fields of learning, cognition, and instructional-design suggest approaches that serve as guidelines for tailoring instruction to meet the needs of all students so that they may participate to the fullest extent possible and progress to increasingly higher levels of expertise. Drawing upon theory, such instruction may be designed by utilizing the steps listed below and displayed graphically in Figure 1.

- Determine broad goals
- Establish an enriched context
- Develop domain-specific goals related to the context
- Use multiple, authentic assessments as a base line for developing individual learning experiences
- Use a variety of strategies and activities that address diverse learning styles
- Provide a variety of media and technology to individualize learning
- Scaffold through constant monitoring and guidance
- Allow time for student work to be self-paced
- Encourage a learning community that values the input of individuals
- Extend learning and transfer in subsequent themes

Figure 1. Model for Designing and Implementing Integrative Thematic Unit for Individualization



## Determine Broad Goals

The first step in designing an individualized, integrated learning environment is to identify the broad picture and goals of society (Harless, 1998). If the ultimate outcome of education is to produce accomplished citizens, then instructional goals must move beyond a subject matter orientation. Rather than developing lessons to teach in response to segregated math, science, and language arts goals, planning should first address broader goals that equip students with the skills, knowledge, and attitudes that will prepare them for various roles in society (Harless, 1998, p.48). Once those broader goals are developed, the teacher may translate them into smaller competencies (Gagne, Briggs, & Wager, 1992 pp. 145-184). Reigeluth's (1999) Elaboration Theory advocates beginning with broader topics within a domain and then progressing to more detailed principles, which provides a sequence that "enables learners to understand the tasks holistically" (p.433). Reigeluth further explains that this type of instruction allows students to develop a schema, which can be expanded through subsequent lessons. Addressing subject matter goals through a rich, integrated, contextualized environment facilitates making meaning and connections of new knowledge.

## Establish a Context

Providing an enriched environment that includes adequate resources and is based upon relevant topics that emphasize real people and places engages and sustains interest (Kovalik 1997; 1999). For example, a fifth grade classroom begins a two-week unit with an around-the-world theme. When the students enter the room on the first Monday of the unit, they find maps, newspapers, pictures, and other artifacts representing various regions from around the world lining the walls and tables of the classroom. Students instantly become immersed in a contextualized environment, which will engage them in activities that promote deeper understanding of people and cultures of the world. These learning experiences will prepare students to become global citizens.

The teacher begins by reading *Letters From Felix* (Langen & Droop, 1994) aloud to the students. This story is about a stuffed rabbit named Felix who gets separated from his owner, Sophie at an airport. Felix boards numerous planes and travels around the world to several countries as he tries to find his way back home to her in Ohio. As Felix stops in each country, he writes a letter to Sophie and includes descriptions, drawings, and pictures of what he sees. As Sophie receives each letter, her family discusses characteristics of the described country. The book has envelopes with pullout copies of these letters. This story sets the context for learning activities and motivates children to learn more about other cultures and regions.

## Develop Domain-Specific Goals

As students take on the role of global citizen during the unit, they develop a greater understanding of their world and develop skills in specific subject areas in meaningful ways. Math, science, social studies, art, language arts, and technology objectives easily emerge and skills are applied in realistic ways. Math goals are addressed as students learn to measure and calculate distances traveled; compare and contrast data; use calculators to compute travel budgets; and add, subtract, multiply, and divide numbers with decimals. Science goals are addressed as students discover global weather patterns and landforms. Learners apply the scientific process as they conduct local weather experiments and compare data with other cities. Social studies goals are attended to as students develop an understanding of diverse cultures, places, and environments. Art goals further such understanding as students study art and artifacts of cultures. For example, students may discover that artists Vincent Van Gogh of the Netherlands, Diego Rivera of Mexico, and Faith Ringgold of the United States all spent time in Europe and created paintings of sunflowers. These kinds of patterns promote dialogue about similarities and differences among countries.

As students use the Internet, software, and word processing to gather and express information, they become proficient in the use of technology, which is in alignment with national technology goals. Language arts goals thread these content area goals as students read, research, speak, and write about global information. Students read a broad range of fictional and non-fictional texts to promote understanding. Regional poetry, music, and folk literature enrich data gathered from encyclopedias, newspapers, and maps. Refer to Figure 2 for an abundant list of goals addressed in this particular unit.

*Figure 2. National Standards Addressed in this Scenario*

National Standards Addressed in this Scenario

SCIENCE

**National Science Education Standards**

<http://www.nap.edu/readingroom/books/nses/>

Students develop understanding of populations, resources, and environments.

Students develop understandings about scientific inquiry.

Students develop abilities necessary to do scientific inquiry.

SOCIAL STUDIES

National Council for the Social Studies

<http://www.socialstudies.org>

Students develop understandings of cultural diversity.

Students develop understandings of people, places, and environments.

Students develop understandings of global connections and interdependence.

MATH

National Council of Teachers of Mathematics

<http://www.nctm.org>

Students understand various meanings of multiplication and division.

Students understand the effects of multiplying and dividing whole numbers.

Students develop fluency in adding, subtracting, multiplying, and dividing whole numbers.

Students understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems.

Select and apply appropriate standard units and tools to measure length, temperature, etc.

Students collect data using observations and experiments.

Students solve problems that arise in mathematics and other contexts.

Students organize and consolidate their mathematical thinking through communication.

LANGUAGE ARTS

National Council of Teachers of English

<http://ncte.org>

Students read a wide range of print and nonprint texts to build an understanding of texts, themselves, and of the cultures of the United States and the world and to acquire new information. Among these texts are fiction and nonfiction.

Students read a wide range of literature in many genres to build an understanding of many dimensions of human experiences.

Students adjust their use of spoken, written, and visual language to communicate effectively with a variety of audiences and for different purposes.

Students conduct research by gathering, evaluating, and synthesizing data from a variety of sources to communicate their discoveries in ways that suit their purpose and audience.

Students use a variety of technological and information resources to gather and synthesize information and to create and communicate knowledge.

Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, persuasion, and the exchange of information).

## ARTS

National Standards for Arts Education

<http://www.didaxinc.com/standards/artstandards.html>

**Students relate various types of arts knowledge and skills within and across the arts disciplines.** This includes mixing and matching competencies and understandings in art-making, history and culture, and analysis in any arts-related project.

**Students develop and present basic analyses of works of art** from structural, historical, and cultural perspectives, and from combinations of those perspectives. This includes the ability to understand and evaluate work in the various arts disciplines.

**Students communicate at a basic level in the four arts disciplines**—dance, music, theatre, and the visual arts. This includes knowledge and skills in the use of the basic vocabularies, materials, tools, techniques, and intellectual methods of each arts discipline.

## TECHNOLOGY

International Society for Technology in Education

<http://cnets.iste.org>

A. Students are proficient in the use of technology.

Students use technology tools to enhance learning, increase productivity, and promote creativity.

Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

Students use technology to locate, evaluate, and collect information from a variety of sources.

Students use technology tools to process data and report results.

### Use Multiple Authentic Assessments

Individualizing instruction is necessary so that *all* students can participate in this unit. If, for example, the reading levels of this fifth grade class range from first to seventh grade, one textbook would not be at an appropriately challenging level for all. Teachers must choose appropriate media and technology to scaffold learners with varied abilities. According to Vygotsky (1978, p.86), each student has a zone of proximal development, which is “the distance between actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.” In order to determine the student’s beginning point of his/her zone of proximal development, teachers should use multiple forms of authentic assessments. The unit’s contextualized activities serve as tasks for assessment. Frederikson & Collins (1989, p.31) advocate that tasks “included within an assessment system would vary from structured tasks that measure students’ understanding of critical concepts or skills to open-ended tasks that allow students to demonstrate special knowledge and creativity”. The many open-ended products throughout this thematic unit provide information about the reading levels, learning styles, strengths, and weaknesses of students that further inform media, technology, and strategy selection during the unit and in subsequent units.

### Use a Variety of Strategies and Activities that Address Diverse Learning Styles

Humans in all cultures use multiple intelligences to solve problems and to create products (Gardner 1983). Gardner’s (1999) intelligences include verbal-linguistic, math-logic, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, and naturalist. Students may be more developed in certain areas, but should have the opportunity to strengthen all intelligences. The eight intelligences should be considered when developing lessons. A variety of teaching and learning strategies can be used to facilitate the development of the intelligences throughout any unit. Refer to Figure 3, which details the ways the multiple intelligences are addressed in this context.

Figure 3. Activities Within Each of the Multiple Intelligences

	Math	Science	Social Studies	Art	Language Arts
Verbal-Linguistic	Discuss budget	Read, write, and report on findings	Read, write, and share orally	Read and write about art/artists; discuss	Read, write, discuss
Math-logic	Compare/contrast distances, compute travel budgets	Identify global weather patterns; compute average temperatures, rainfall, etc.	Further understanding through dates, distances, etc.	Understand art periods through timelines, etc.	Classify data for reports and projects
Spatial	Use maps to gather data	Read weather maps and charts	Use maps, timelines, and other visuals	Critique and create art	Use visuals (in addition to text) to gather information
Bodily-Kinesthetic	Use manipulatives to explore concepts	Use weather instruments to gather data; conduct experiments	Role-play: make a travel commercial and videotape; create interactive projects (envelope reports, rabbits, etc.)	Create art pieces	Learn through hands-on activities
Musical			Listen to national anthems and regional music	Listen to music that coincides with the time period of an art piece	Further understanding of cultures through poetry and music
Interpersonal	Work collaboratively to solve problems	Work cooperatively with others to locate and analyze data	Work with others	Relate to others through art	Cooperate with others
Intrapersonal	Work independently to solve problems; work at own pace	Work independently; work at own pace	Work independently; work at own pace	Express oneself through art	Work independently and at own pace
Naturalist		Explore weather patterns and collect data outdoors		Use live objects and the outdoors when creating art	

### Provide a Variety of Media and Technology

Media and technology are powerful tools in aiding a teacher in individualizing instruction. Media may be selected so that each student is working within her zone of proximal development. Multimedia programs increase acquisition and retention of information by enlisting a variety of senses as students gather data visually and aurally. Technology has a dichotomous role in individualizing instruction because it gives students control over their learning and adapts to their responses accordingly.

After *Letters From Felix* (Langen & Droop, 1994) is read and discussed, students label maps and chart Felix's path of travel. Then, students form heterogeneous groups to further research one of the countries he visited. Knowing the reading levels is critical for this activity. Books about countries that are written with larger print, provide more pictures, and use simpler sentence structures scaffold lower-level readers. The series that includes *Postcards From Russia* (Arnold, 1996) and *Postcards From Mexico* (Arnold, 1996) serve this purpose. Books that have more sophisticated vocabulary and sentence structure, such as *The Portable World Factbook* (Lye, 1995), are

more appropriate for higher-level readers. These books, in conjunction with software, scaffold group members as they refine their research skills and seek details about their assigned country. The groups use IBM's *World Book Millennium 2000* CD-ROM to quickly locate pictures, music clips, timelines, and maps. This software is motivating, appeals to diverse learning styles, and enables students to quickly access detailed information about related topics by linking to other articles on the disk's encyclopedia. The plethora of visual information allows children with limited English proficiency or learning disabilities to gather data without having to rely on text.

### **Scaffold Through Monitoring and Guidance**

The teacher serves as a guide through this research process and as Jonassen (1999, p.230-6) describes, may provide modeling and coaching to further scaffold learners. The teacher may demonstrate note taking, highlighting, concept mapping, and software usage. As students work, the teacher monitors and informally assesses progress. Students apply their new knowledge about their country by writing a detailed letter to Sophie from the perspective of Felix. Writing on transparencies facilitates sharing, as the letters can be projected onto a larger screen. Groups may use a combination of text and drawings, as Felix did, to convey interesting details about their assigned country.

Groups may work at their own pace to complete letters and share accordingly. If others finish earlier, they may go on to individually research a country that was not mentioned in the story. Software, leveled books, maps, and other resources scaffold students as they apply their research skills in a new assignment. Text and drawings depicting the country's characteristics are added to index cards that are placed into envelopes. Separating and labeling data on cards by categories such as climate, economy, government, history, flag, location, and population promotes classification skills. Finished envelopes are displayed on an interactive bulletin board, so that classmates may explore envelopes and read about other countries. For students with writing, spelling, and drawing challenges, additional software such as *Storybook Weaver Deluxe*, *Start Write*, *Creative Writer*, and *Word* may be used so that all students can participate. Printed documents can be inserted into the envelopes instead of index cards.

Some students may finish before others. As they do, they are given paper cutouts of rabbits. Students synthesize information from their envelope research projects and use text and drawings to depict their country's characteristics on one side of the rabbit. They use resources to locate and express the same kind of information about their home state on the opposite side of the rabbit. The rabbits are hung with string from the ceiling and provide continuity for the context of Felix, the world traveler.

### **Allow Time for Student Work to be Self-Paced**

Imagine this fifth grade classroom: as students complete their envelopes, others are comparing and contrasting state and country facts on paper rabbits, while others are moving on to the next task at their own pace. Carroll (1963) posits that students learn at varying rates and should be given adequate time to learn new material. He suggests that as students master objectives before others, they go on to participate in enrichment activities. Ample time to "thoroughly explore, understand, and use information and skills" (Kovalik 1997; 1999) leads to comprehensive understanding. Opportunities to repeat skills within the same theme and in subsequent themes extends schema and reinforces learning (Reigeluth 1999; Kovalik 1997; 1999).

### **Encourage a Learning Community**

Next, learners are grouped into pairs. The teacher discusses persuasion and how it is used. The pairs choose a country to research and use the facts to persuade people to visit this country via a travel commercial. Students write a persuasive script, include five to ten details about the country, construct a backdrop and props, and present a travel commercial in front of the class as the teacher video tapes it for later review. This experience provides yet another form of assessment for the teacher and allows students to capitalize on and increase their intelligences as Gardner (1983, 1999) suggests. In this case, the travel commercial engages students in role-playing and collaboration to increase understanding.

All students may not complete a travel commercial. When most students complete most tasks, the class explores and discusses the format of local, national, and international newspapers. The unit's culminating project is the creation of a global newspaper. This project promotes community and collaboration through problem solving, planning, and coordination. Since knowledge is distributed among the students in the classroom community (Hewitt & Scardamalia 1998), knowledge is shared (Scardamalia & Bereiter, 1994) as students rely on each other to build knowledge and complete the task (Bell & Winn, 2000, p.128-9). This project promotes individualized instruction within a community setting. Students, who are most interested in sports, may report on current sporting events from

around the world. Students motivated by scientific topics may report on global weather conditions or current innovations in medicine and technology. Students intrigued by numbers and patterns (Gardner 1999) may report on business trends or compute average temperatures around the world. Others may use narratives (Gardner 1999) to express insights into diverse cultures. Creating a class newspaper is a large undertaking and requires all students to contribute to ensure its completion. This implies that participants have a shared interest (Wenger, 1998) and are motivated to work together to make a collective product (Scardmalia & Bereiter, 1994). Software, such as *Creative Writer*, provides a template to create a newspaper where students make choices about the number of columns and the type of font, headlines, borders, and graphics to be used. The Internet serves as another scaffolding tool to help learners acquire current information for their newspaper articles. The final product serves as another assessment piece and can be shared with younger grades or community members.

### **Extend Learning and Transfer in Subsequent Themes**

One measure of learning is the ability to transfer new knowledge to other contexts. Though not proponents of situated learning environments, Anderson, Reder, and Simon (1996) studied the work of others to determine three components related to transfer. Their findings indicate: (1) there are varying degrees of transfer, including negative transfer; (2) representation and degree of practice are major determinants of transfer between tasks, and transfer between different domains varies directly with the number of symbolic components shared between them; and (3) the amount of transfer depends on where attention is drawn during instruction (p. 6-8).

To increase the degree of transfer, subsequent themes may be developed that review and expand on the skills learned in the first unit. Using similar characters and tasks in later units facilitates the transfer of knowledge and provides students a framework to build knowledge upon in new contexts. For example, Felix's travels may lead to further inquiry as he visits the moon in *Felix Explores Planet Earth* (Langen & Droop, 1996) or as he travels back through history in *Felix Travels Back in Time* (Langen & Droop, 1995). Felix may even be introduced to another traveler such as Flat Stanley, who slips through the mail. Flat Stanley is a young boy who fits into envelopes because he was flattened by a bulletin board temporarily in *Flat Stanley* (Brown, 1964; 1992). Units developed around these stories and characters serve to extend prior knowledge in new ways so that students may progress toward increasingly difficult objectives. This kind of connected, threaded curriculum helps learners' brains seek patterns and develop a mental organizer to extract from over and over again (Kovalik 1997; 1999).

### **Applying Theory: Why This Works**

This sample unit exemplifies components of learning models espoused by experts. This unit promotes knowledge construction through hands-on activities, collaboration, problem solving, and active engagement (Abdul-Haqq, 1998). The varied activities address diverse learning styles by appealing to visual, oral, auditory, and tactual senses and employ multiple intelligences (Gardner 1999) by engaging students in collaboration, mathematical computation, hands-on activities, and role-playing. Retention of material is greatly increased as Sousa (2001, p.95) explains the average retention rate 24 hours after lecture is 5% ; after reading is 10%; after audiovisual exposure is 20%; is 30% after demonstration; is 50% after discussion; is 75% after practice by doing; and after immediate use of learning is 90%.

Understanding is further increased through the pursuit of broad goals in thematic, integrated contexts where media and technology scaffold learners as they complete individual and group projects. Since students collaborate and share knowledge at different points in the unit, they develop cooperation skills that can be applied later in real life situations. Students simultaneously learn that everyone has an area of expertise and something to contribute. The continual application of skills in different contexts during the unit leads to mastery of both knowledge and skills in a threaded manner that can be revisited in subsequent lessons. Through this holistic approach to instruction, teachers facilitate the development of multifaceted citizens who are better prepared for a global society and its diversity, which is the ultimate goal of education.

### **References**

- Abdul-Haqq, I. (1998). *Constructivism in teacher education: Considerations for those who would link practice to theory*. Washington D.C.: Clearinghouse on Teaching and Teacher Education. (ERIC Document Reproduction Services No. ED 426 986).
- Anderson, J. R., Reder, L. M., & Simon, H. A. (1996). Situated learning and education. *Educational Researcher*, 25 (4), 5-11.



- Arnold, H. (1996). *Postcards from Mexico*. Austin, TX: Steck-Vaughn Publishers.
- Arnold, H. (1996). *Postcards from Russia*. Austin, TX: Steck-Vaughn Publishers.
- Bell, P. & Winn, W. (2000). Distributed cognitions: By nature and by design. In D. H. Jonassen & S. M. Land (Eds.) *Theoretical Foundations of Learning Environments*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Brown, J. S. , Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Brown, J. (1964;1992). *Flat Stanley*. New York: Harper Trophy.
- Carroll, J. B. (1963). A model of school learning. *Teachers College Record*, 64, 723-733.
- Frederikson J., & Collins A. (1989). A systems approach to educational testing. *Educational Researcher*, 18(9), 27-32.
- Gagne, R. M., Briggs, L. J. & Wager, W. W. (1992). *Principles of instructional design*. ( 4<sup>th</sup> ed.). Orlando, FL: Holt, Rinehart, and Winston.
- Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.
- Gardner, H. (1999). *Intelligence reframed: Multiple intelligences for the 21<sup>st</sup> century*. New York: Basic Books.
- Gardner, H. (1999). Multiple approaches to understanding. In Charles M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory: Volume II*. (pp.69-89). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Harless, J. (1998). *The Eden conspiracy: Educating for accomplished citizenship*. Wheaton, IL: Guild V Publications.
- Hewitt J. & Scardamalia, M. (1998). Design principles for distributed knowledge building process. *Educational Psychology Review*, 10(1), 75-96.
- Jonassen, D. (1999). Designing constructivist learning environments. In Charles M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory: Volume II*. (pp.215-239). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Kovalik, S. (1997). *ITI: The Model* (3<sup>rd</sup> ed.). Kent, WA: Susan Kovalik & Assoc.
- Kovalik, S.(1999). Integrated thematic instruction: From brain research to application. In Charles M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory: Volume II*. (pp.371-396). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Langen, A. & Droop, C. (1994). *Letters from Felix*. New York: Abbeville Press.
- Langen, A. & Droop, C. (1995). *Felix travels back in time*. New York: Abbeville Press.
- Langen, A. & Droop, C. (1996). *Felix explores planet earth*. New York: Abbeville Press.
- Lye, K. (1995). *The portable world factbook*. New York: Avon Books.
- Reigeluth, C. M. (1999). The elaboration theory: Guidance for scope and sequence decisions. In Charles M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory: Volume II*. (pp.425-453). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Salomon, G. Perkins, D. N., & Globerson, T. (1991). Partners in cognition: Extending human intelligence with intelligent technologies. *Educational Researcher*, 20 (3), 2-9.
- Scardamalia, M. & Bereiter, C. (1994). Computer support for knowledge-building communities. *The Journal of the Learning Sciences*, 3(3), 265-283.
- Sousa, D. (2001). *How the brain learns* (2<sup>nd</sup> ed.). Thousand Oaks, CA: Corwin Press, Inc.
- Spiro, R. J., Feltovich, P. J., Jacobson, M. J., & Coulson, R. L. (1991). Cognitive flexibility, constructivism, and hypertext. Random access instruction for advanced knowledge acquisition in ill-structured domains. *Educational Technology*, 31 (5) 24-33.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Wenger, E. (1998). Communities of practice: Learning as a social system. *Systems Thinker*. [Online] Available: <http://www.co-i-l.com/coil/knowledge-garden/cop/lss.shtml>

## East Meets West Times 2: Impact of Cultural Change at Two Universities on Asian Students

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### Abstract

*Asian students arriving at American universities are subject to massive cultural change, especially if it is their first time being in the United States. Taking concepts from Change Theory (Rogers, 1983 and Havelock & Zlotolow, 1995) and combining it with those of the Affective Domain (Martin & Briggs, 1986), the authors present a cultural adaptation model that may prove useful in working with Asian students in American Universities.*

### Introduction

Every day that passes presents massive change to students and instructors at all levels of education. Nowhere are these changes more evident than in the area of instructional technology, especially at the postsecondary level. This scenario is doubly complex when the participants are from countries other than where they were born and raised. Instructors and administrators in universities can take steps to insure a smooth transition from one culture to the next by addressing a multiplicity of levels that impact students and instructors from abroad.

This paper addresses the affective domain, and how concerns related to the initial well being of international participants first has its focus on basic survival skills. We readily acknowledge that subsequent focus will ultimately center on cognitive skills but will reserve most of that discussion for another time and place.

### Background

During the 2000 AECT-Denver, a group of Asian students shared their concerns about coming to the United States to study in instructional technology program areas. Using Maslow's Hierarchy as a metaphor, they traced a number of areas of concern, most of which revolved around affective domain issues. These included being accepted by their American peers, working in harmony with teams, knowing what to wear, shopping for ethnic foods, developing an understanding relationship with their instructors, dating, establishing friendships, and more.

Harvard's Dr. Robert Doyle hosted the session and in his summary remarks, indicated that this was one of the most valuable and insightful sessions that he has attended in many years. This paper reviews some of the issues discussed during the Denver conference and connects them more directly to the affective domain and change theory. The work of Bloom (1956), Cotton (1995), Martin and Briggs (1986), Rogers (1983); Havelock & Zlotolow (1995) contain significant implications as to development of viable strategies to ease the transition of international students and instructors into the academic and personal mainstream of the countries in which they choose to study. Multicultural theories cited by a number of other writers connect the dots related to affective and change and thus create a better understanding (Lewis, 2000; Mead, 1998; Morrison, Conaway & Douress, 2000). While these latter authors mainly address multicultural elements related to business, it is our belief that many graduates of instructional technology programs will find themselves facing dilemmas within the context of multinational organizations.

### Differing Issues Identified

In the following pages the reader will experience something very remarkable – articulate concerns expressed by a number of students, few of whom were able to speak English with fluency less than two years ago. They are now not only able to write with considerable precision but, when asked to deliver their material verbally, do so with confidence and enthusiasm. Those same students, twenty-four months previous, would have remained mostly mute.

The reasons for such changes are in part, due to caring faculty members who very quickly identify communication problems with their international students. Rogers (1983, p. 321) describes part of the problem:

Change agent [professors] empathy with clients [students] is especially difficult when the clients are very different from the changer agent; we expect change agents to be more successful if they can empathize with their client. Although there is very little empirical support for this expectation, we tentatively suggest  
Generalization 9-4: *Change agent success is positively related to empathy with clients.*

Rogers adds:

If empathy is important in change agent effectiveness, how can it be increased? One method lies in the selection of change agents; those who have been in the client's role are better able to empathize with it. For example, agricultural agencies often seek to employ change agents who have come from farm backgrounds.

While we do not advocate that all professors who teach international students mirror the ethnicity of their learners, we feel that a faculty member who has prior international experience is more inclined to be empathetic than one who has not. If a professor has several international students in his or her class, there is a strong likelihood that they reflect an educational experience that has been formal, hierarchal, and pedagogically behaviorist. Martin and Briggs (1986, p. x) describe what the contemporary educator emphasizes when they state: "The stronghold of behaviorism has lessened, and cognitive inquiry, cognitive-information processing, and humanistic and developmental ideologies and theories have been revised, modified, or developed to meet new needs." Indeed, what is an international student to think when confronted with a professor who actually encourages their students to think and do for themselves, to manage much of their own learning?

Martin and Briggs (p. x) articulate the potential for future problems among international students of rigid academic backgrounds when they discuss evolving curricular changes in that "...the focus of curricular and instructional content has broadened. Affective aspects of the curriculum are now being incorporated into lessons and units. Attention to attitudes, values, ethics, morals and the self-esteem of learners is demanding time, energy, and effort, alongside the important cognitive dimensions of curricula." Given these changes in pedagogy, how do our international students view such changes? How do they adapt and subsequently for some, adopt the change in how they view both studies and life in an American university?

Indeed, the following short essays written by several Asian students, all of whom brought with them pedagogical rigidity, provides a near-alarming look at how they perceive their professors and how they have adapted to such change. Appended to some of the essays are recommendations; others declined to offer such.

There is some degree of overlapping ideas presented, primarily due to the reality that many of the affective issues they raise are woven into the larger fabric of work and life outside the classroom.

### **Interaction with Peer Students** **By Corey Lee**

Extensive research in effective teaching and learning emphasizes the significance of social interaction. According to Vygotsky (1978) social development theory, social interaction is vital to cognitive development; all higher-order functions originate because of interaction among individuals. In light of this, the amount and type of classroom interaction cannot be ignored when examining Chinese students' learning in the United States.

It has been recognized that Chinese students pursuing a higher education in Western countries demonstrate limited interaction in American classrooms (Tu, 2001). Several factors might contribute to Chinese students' inadequate participation.

First, the foundation of Chinese education is grounded in Confucianism, in which values and morals are much different from Western philosophy (Brooks, 1997). While individualism, assertiveness, and sometimes, aggressiveness are often promoted in Western society, silence and temperance are valued in Chinese society. Consequently in communication, Chinese places the “emphasis... on the receiver and listening rather than the sender or speech making” (Yum, 1994, p.83). Therefore, in a classroom environment, Chinese students tend to be more conservative and quiet than are their American counterparts.

Second, the presence of a rigid hierarchical system, valued in Confucianism, leads Chinese students to regard their teacher as an “all-knowing” savant on stage with absolute authority over the subject matter. One’s teacher is the sole source of knowledge in Chinese classrooms. With this mentality, discussion and interaction among students are considered trivial and, sometimes, useless.

Third, even when Chinese students are willing to participate in classroom discussions, they fear expressing what may be erroneous opinions to fellow students, which leads to embarrassment or creation of a negative impression. Therefore, Chinese students are often considered a silent group in the American classroom. Despite the instructor’s encouragement, they are reluctant to express their feelings or opinions and to participate in classroom discussions (Tu, 2001).

Finally, reduced or no interaction by Chinese students also originates from their limited ability to speak English, which restricts their participation in the classroom. In Taiwan and China, English language education predominately emphasized reading and writing; little attention was paid to listening and speaking. As many Chinese students come to the United States, they lack sufficient communication skills, which hinders their classroom participation. Moreover, the swift change of discussion topics in the classroom poses an even greater problem in this situation (Tu, 2001). As Chinese students struggle to conceptualize the subject just discussed, the focus changes to the next topic.

Having a cultural background rooted in Confucianism and deficiency in English capability, Chinese students exhibit far less interaction and participation in American classrooms. By being sensitive to these difficulties that face Chinese students, the Western teacher can play an active role in facilitating far more productive interactions between and among Chinese and American students.

Some suggested techniques are:

1. Rather than call on a Chinese student in front of the class, form students into small groups and let the group consensus be reported by one among them, ensuring that the person providing the answer is not always Western.
2. Have students write an answer to a question and randomly call on *all* students in the class, including those who are Chinese. Having sufficient time to frame an adequate response will generate more appropriate replies, thus lessen the loss of face feared by the Chinese student.
3. Have the students create a one-slide Power Point response to a question, assigned in advance. Having prepared before class, (and the Chinese students will invariably have done so), reduces anxiety, and allows all students to contribute equally.
4. Involve Chinese students in panel discussions wherein they are members of a team and, as such, will feel increased responsibility to participate.
5. As the Chinese students become more familiar with other members of the class, and with the techniques listed, they eventually should be called upon individually, to reply in class. When a teacher does not call upon the Chinese students or lets them off with low-order responses, no one is served.

Cultural and pedagogical assimilation for Chinese students can be extremely uncomfortable, especially during the beginning semesters in a Western university environment. The sensitive teacher will accommodate this discomfort by gradually moving their Chinese students into the mainstream of classroom activities. By showing concern for such students from the beginning, the good teacher can make the educational experiences of their Chinese students productive, fulfilling, and yes, even enjoyable.

### **On Chinese Self-Discipline** **By Cheng-Chang Pan**

When it comes to self-discipline and its role and impact on multicultural learning environments, Chinese students tend to acquire and value self-discipline. According to Ritts (2000), self-discipline as well as other qualities are passed on to new generations by “training” or Chao-shun, acquired from parents, and rooted in Confucianism.

Confucius’ teachings have been conveyed to his descendants culturally and individually, and have had a major impact on the ethnic group. Confucius was temperate and self-disciplined, and he was a man of wisdom and good manners (Beck, 2001).

A perspective of social learning theory holds that individuals learn by interacting and observing others as to how new behaviors are performed. Kearsley (2001) supports this concept when he states that "...individuals are more likely to adopt a modeled behavior if it results in outcomes they value."

Chinese students, given their heritage, are inclined to place authority figures in high esteem. Teachers, for instance, are highly valued by students, which may not be the same elsewhere.

Given the author's experiences in Taiwan, teachers are also highly valued in society. Teaching positions are gaining in popularity as the economy shrinks and slows. Affectively speaking, students honor themselves when listening to the authority's lectures, so they model the authority and follow the authority's teaching. Therefore, they pride themselves in being a follower of the master.

Individually, Chinese students are apt to accomplish tasks designated by the authority to demonstrate their capabilities and thus reflect their potential. They seldom ask questions in class, in part because they feel ashamed to do so. Those individuals are ones who wish they had been better prepared before coming to class.

When Chinese students come to the Western world, they encounter a great cultural impact. While accommodating themselves to the foreign country, they are assimilating themselves into this melting pot, in hopes they will adjust to the new environment sooner and stand out among their fellow classmates. *If they take a hybrid stand and merge self-discipline from the East with assertiveness from the West, Chinese students will have a promising future in the foreign environment.*

### **Professor-Student Interaction** **By Zhengzi Wang**

As an Asian student intending to study in the United States, a main concern was how to establish contact with professors in the department. It is well known that professors are key sources of information about assistantships, or even scholarships. E-mail became this author's best method for communication with the professors. First, it was possible to proofread letters to professors and others at the chosen university many times. Secondly, it was fast and there was no need to make an appointment with the professor. Other Asian students had the same experience. Many Asian students begin to communicate with their professors long before they get admitted to the universities in the U.S. The author corresponded over 100 times with her professor before coming to the United States.

The professor is generally the first and the only person that an international student can comfortably contact. Students will probably throw a wide range of questions at their future professors, from admission procedures, to cultural issues, to advice about the apartment rentals. In this case, a professor, who is already busy in daily life, must meet the challenge of efficiently dealing with these inquires. Students should reserve their difficult questions— i.e., how can I get an assistantship? — for professors, while answering simpler questions using the variety of resources available, such as the Internet, friends, books, their chosen university's website, etc.

China's cultural system is based not on the strength of the individual, but on the pattern of relationships maintained by all people. In communication, the Chinese put emphasis on the receiver of messages and on listening rather than on the sender (Brooks, 1997). As Bond & Hwang (1986) have pointed out, "the western starting point of the anomic individual is alien to Chinese considerations of man's social behavior, which see man as a relational being, socially situated and defined within an interactive context."

Due to the utterly different cultural factors, a lot of Asian students experience difficulty when adjusting themselves to the American classroom culture. Silence is not golden anymore. American peers are eloquent, talkative, and humorous in class. Sometimes, we feel much pressure competing with them for the professor's attention. A lot of negative self-talk generally results, "I don't understand my professor's words, what shall I do?" "I don't agree with the professor, so should I confront him right away?" "I want to go to the restroom, but can I leave when the professor is talking?" "Oh, she speaks so fast! I couldn't even understand a word!" So, many Asian students, like the author, don't participate in class at the beginning, even if they can speak English well. Consequently, some concerns arise. "What will the professor think about me? Dumb? Slow-learner?" "Does he know I am smart enough to understand what he said, but just didn't speak out?"

There is solid social background behind this thinking. Confucian philosophy permeates the whole of Chinese society. Confucius believed that a hierarchical system was essential to the harmonious well being of society. This, in turn, is reflected in the Chinese classroom. Students regard their teacher as all knowing, and the absolute authority on the subject matter. Due to the rigid teacher-student relationship, Chinese teachers are under severe pressure not to make mistakes, not to misguide students, and not to be criticized. Such behavior on their part allows the teacher to maintain their "all-knowing" and "ever-correct" status. It is the duty of students to give the

utmost respect to their teacher. Thus, to ask questions of the teacher is tantamount to questioning the position of the teacher, and therefore is not a feature of Chinese classrooms. Rigid order and formality are the main features of the Chinese learning environment. Chinese teachers and students know that the classroom is a place where serious knowledge is taught.

The major concern of Asian students is that their American professors think less of them because they don't speak a lot. Professors need to be aware that classroom participation does not always mean "shouting and yelling and hands up". A lot of times, Asian students participate in class in a different way. They do more critical thinking in their minds. Sometimes, it's better to give the floor to Asian students rather than waiting for a general response. On the other hand, students shouldn't get too self-conscious about themselves speaking English with an accent. They should practice English more to overcome the initial fear of speaking English in public.

A rewarding college experience is typically viewed as students in a classroom busily engaged in the pursuit of learning with their professors. Missing from this picture are faculty and students interacting outside of the classroom environment. Yet this less common image is equally important to a successful college experience (Maestas, 2000).

In the author's college days back in China, we seldom had social contacts with the professors. Mostly, we met our professors in class, discussing serious academic issues. Teachers are considered as an authority figure, and it was hard to look at them as a person.

In the United States Chinese students can access their professors through e-mail 24 hours a day, 7 days a week, discussing academic issues. Also, some professors like to entertain international students in their homes, to celebrate special occasions. This is a good time and place to talk to the professors, letting him/her know you as a person. In our program, all the international students are regularly invited as guests to our professors' house to celebrate Thanksgiving, Christmas, Chinese New Year, Autumn Festival, etc.

Asian students should establish an academic contact as well as a social contact with the professors. In this way, they can get more attention and demand more interest from professors about their studies.

The fact that all the international students pay far more tuition more than local residents is a reality. Consequently, rightly or wrongly, we expect quality education as well as cultural enrichment. Lack of communication and a restrictive cultural notion of propriety seem to be the major obstacles to professor-student interactions, as each attempts to find ways to balance tradition and modernization. It takes time for both sides to realize the gap and to improve mutual understanding.

### **The Purpose of Seeking a Graduate Degree in America By Alan Ku**

Every year hundreds of thousands of Chinese students come to America for advanced studies. Why do they choose to fly thousands of miles from home, leaving their families and friends behind to go to an unfamiliar country where language, culture, life style, and language are so different? This essay has a focus on their objectives in engaging in study abroad and examines different motivations between those students studying abroad and their American counterparts.

First, American and Chinese students place different utilitarian value to a graduate diploma. To American students, obtaining a graduate degree means they have more professional knowledge and skills in their field, therefore they have a better opportunity to upgrade their existing position and earn a higher salary. But to Chinese students, a graduate degree, especially from the United States, not only increases the likelihood of employment; but also promotes social status. This is because, in Chinese society, the diploma he or she holds largely determines a person's dignity and value. Therefore, although obtaining a Masters degree takes much time and money, they still choose this path.

The second factor that drives Chinese students is pressure from the family. In the traditional Chinese culture, children receive continuing support from their family throughout their schooling. Chinese parents consider it is their responsibility to do so. In addition, Chinese parents encourage their children to pursue higher degrees and sometimes even make that decision for their children. Most Chinese students follow their parents' wishes when attending graduate school. This is both a natural and inseparable condition in Chinese society.

On the contrary, American students do not expect their parents to pay for their tuition for higher education. American parents, unlike their Chinese counterparts, do not expect their children to look after them in the sunset of their life. The result is that most American students make their own decisions when choosing their major and are not in a hurry to obtain a graduate degree!

### **The Classroom Environment**

**By Terry Tao**

According to MacAulay (1990), “A classroom environment consists of the intellectual, social, and physical conditions within or exogenous to a classroom that influence the learning situation.”

It is not difficult to identify a variety of physical factors that affect how students feel about their classroom environment. Following is a sampling of available information that supports the need to consider many aspects of the classroom climate in order to create an environment for maximum learning.

Environments that are psychologically or emotionally negative inhibit learning (Midjaas, 1984). Studies have found direct correlations between students' cognitive styles and responsiveness to environmental characteristics. In responsive classroom environments, students' achievement increased (Dunn and Dunn 1992). Many classrooms in American universities are better equipped than in other countries. Normally in every American university's classroom, there are projectors, computers, and a central air conditioning system.

Fewer students in a larger instructional space enhance the use of available resources. Spaces where high density and few resources exist add to increased student/teacher conflict and poor student-to-student behavior (Midjaas, 1984). When comparing the population density, United States' class sizes are much smaller than in Asian countries. All these advanced physical classroom environments enrich the quality for studying by international students in the United States.

The amount and quality of classroom light is conducive to 1) greater comfort and contentment; 2) a more cheerful environment; 3) more concentration and a greater desire to work; 4) less fatigue and therefore fewer related side-effects, such as laziness, bad posture, nervousness, and lack of interest; and 5) greater accuracy and neatness (Hathaway, 1983). Use of blues and greens fosters feelings of relaxation. Use of red and orange colors in instructional areas induces anxiety behaviors (Weinstein, 1981). Color affects changes in mood, emotional states, psychomotor performance, muscular activity, rate of breathing, pulse rate, and blood pressure (Hathaway, 1983).

When referring to a cheerful, cozy and comfortable classroom design, there are two minor differences between United States university classrooms and Asian university classrooms.

In American universities, many classrooms have no windows. This amazes me Chinese students when first entering the classroom. There are two primary reasons for this difference: projected visuals will be viewed better without windows and the scene outside of the window will not distract students. Actually, there is no clear-cut relationship between the noises associated with school and student performance on task (Arends, 1994). In Asia, it is very typical construction design to put some windows in the classroom, and plant some trees outside of the window to block the students' view. In most Asians minds, the best place for studying (sometime they call it training) is a place with nice natural environment and fresh cool air. The film “Crouching Tiger Hidden Dragon”, depicted a good Asian sense as to the ideal training environment.

Another difference is the design of both seats and desks. In American universities, many classrooms do not have desks for students. Frequently there is only a piece of board combined with the chair. However, in Asian Universities, every classroom has desks for students. Asian students received extensive training on how to write when they are growing up. For example, when Chinese children are doing their homework, they are required to sit up straight and put two hands on the paper. In order to adjust the children's study habits and develop good attitudes, correcting their sitting and writing style is a good way in the Asian parents and teachers minds to maintain a positive study attitude. Gradually the connection between desks and writing is solidified. Therefore, some professors will feel curious that many Asian students seldom take notes during the class, when there are no real desks available.

Personally, this author feels that the physical side of the classroom environment is not as big a problem for international students as compared to the “soft” side of the classroom environment.

What is the intellectual and social environment within the classroom? What takes place during the time before the class begins, during the class break, and after class? We can call it social time. Normally in every country, students will cherish it and make friends with their classmates. They will naturally divided into several little groups and chat with each other.

Rogers (p. 71) felt that ...”interpersonal networks among peers energizes the [diffusion] process. He goes on to state that one of the important roles of [diffusion] leaders (professors?) was to interconnect the spatially related cliques of the village” and that” a general conclusion from who-to-whom studies is that space and social distance are the main determinants of who talks to whom in diffusion networks [classes].” Herein lies a sensitivity point for professors to ponder.

For international students, these social times are frequently the most uncomfortable. There are several reasons that lead to them felt embarrassed or uncomfortable. First, the language barrier is the main reason. For international students, English is their second language. There are so many different accents, slang, and terms. Second, unfamiliar topics are another reason. Most of the time, international students feel they have nothing in

common to talk about related to these topics. Therefore, it is not strange that most international students just remain quiet.

This kind of classroom environment will definitely influence the learning of international students. As international students, we need do lots of work from our side. We cannot complain that it is “discrimination”. Learning the culture and communication skills is as important as learning academic content. Of course, some times we also need the professors’ help to open up some possibilities for students to know each other. It is also very important to establish collaborative learning. Different professors some times really can make a big difference. This author took some courses in which he made several very good friends; and he also took some courses in which he did not know any of his classmate’s names.

There are several other things about classroom environment. For example, an instructor’s personality often determines the type of classroom environment. Tonelson (1981) had no doubt about the interconnectedness of teacher personality and the learning atmosphere in a classroom. He suggested a mechanism whereby the teacher’s personality can affect student-learning outcomes through the psychological environment of the classroom. He believed that this environment was essentially the product of the kinds of interactions teachers have with students. He argued that the character of the teacher is translated into the working social atmosphere of the classroom, which in turn, influences students. That type of atmosphere sets the stage for learning. For international students, an instructor’s personality can significantly interfere with their learning. A good instructor must demonstrate a repertoire of appropriate interpersonal and pedagogical skills. In the classroom, students learn knowledge, adapt to the instructor’s personality, absorb the culture, and master communication skills simultaneously.

## Conclusions

Martin and Briggs (p. 449), in summarizing their seminal work, include the statement that, “we believe that the cognitive evaluations that individuals attach to feelings, the category emotions, underlie the individual’s development of attitudes, interests, social competence, and other related affective categories. Feelings, we propose, are generally attached to emotions, at least as the way we have defined them.” It is this development within our international students that each of us is charged to cultivate. The essays we include in this article address each of these concerns and more.

The process of interweaving multicultural elements with change and affect theories, while complex in its execution, will hopefully give insight as to the nature of innumerable problems faced by students and instructors when they go abroad for study and teaching. What we have indicated as being problems faced by Asian students are, in reality, those faced by *all students*, no matter from where they may have come.

## References

- Arends, R. (1994). *Learning to teach*. New York: McGraw-Hill.
- Beck, S. (2001). Confucius and Socrates compared. Retrieved November 1, 2001 from <http://www.san.beck.org/C&S-Compared.html>
- Bloom, B.S., Englehart, M.D., Furst, E.J., Hill, W.H., & Krathwohl, D.R. (1956). A taxonomy of educational objectives: Handbook I. *The cognitive domain*. New York: McKay.
- Bond, M.H. and Hwang, K. (1986). The social psychology of Chinese people. In M. H. Bond (Ed.) *The psychology of the Chinese people*, Hong Kong: Oxford University Press.
- Brooks, A. R. (1997). *Learning strategies as learning inhibitors for Chinese speakers*. (ERIC Document Reproduction Service No. ED 411 680)
- Cotton, J. (1995). *The theory of learning strategies: an introduction*. Cork, Ireland: Stylus Publishing.
- Dunn, R., and Dunn, K. (1992). *Teaching elementary students through their individual learning styles: practical approaches for grades 3-6*. Needham Heights, MA: Allyn and Bacon.
- Hathaway, W. (1983). Lights, windows, color: Elements of the school environment. *CEFP Journal*, 21(3), 33-35.
- Havelock. R.G. & Zlotolow, S. (1995). *The change agent’s guide*. 2nd Ed. Englewood Cliffs, NJ: Educational Technology Publications..
- Kearsley, G. (2001). *Explorations in learning and instruction: The theory into practice database*. Retrieved November 1, 2001 from <http://home.sprynet.com/~gkearsley/tip/bandura.html>
- Lewis, R.D. (2000). *When cultures collide: Managing successfully across cultures*. London: Nicolas Brealey Publishing Ltd.



- Martin, B. L., and Briggs, L. J. (1986). *The affective and cognitive domains: integration for instruction and research*. Englewood Cliffs, NJ: Educational Technology Publications.
- MacAulay, D.J. (1990). Classroom environment: A literature review. *Educational Psychology: An International Journal of Experimental Psychology*, pp. 239-53. ERIC Document Reproduction Service No. EJ438472.
- Mead, R. (1998). *International management: cross-cultural dimensions*. Oxford, UK: Blackwell Publishers Ltd.
- Midjaas, C. L. (1984). Use of Space. In J.W. Keefe and J.M. Jenkins (Eds.), *Instructional leadership handbook*. Reston, VA: National Association of Secondary School Principals.
- Morrison, T., Conaway, W. A., & Douress, J. J. (2001). *Dun and Bradstreet's guide to doing business around the world*. Paramus, NJ: Prentice Hall.
- Ritts, V. (2000). *Infusing culture into parental issues: A supplement for psychology instructors*. Retrieved on November 1, 2001 from <http://www.stlcc.cc.mo.us/mc/users/vritts/culture.htm>
- Rogers, E. M. (1983). *Diffusion of innovation*. 3rd ed. NY: The Free Press, a Division of Macmillan Publishing.
- Tonelson, S. W. (1981). The importance of teacher self-concept to create a healthy psychological environment for learning. *Education*, 102, 96-100.
- Tu, C. (2001). How Chinese perceive social presence: An examination of interaction in online learning environment. *Educational Media International*, 38(1), 45-60.
- Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA, Harvard University Press.
- Weinstein, C. (1981). Classroom design as an external condition for learning. *Educational Technology* (August 1981): 12-18.
- Yum, J. O. (1994). The impact of Confucianism on interpersonal relationships and communication patterns in East Asia. In L. A. Samovar & R. E. Porter (Eds.), *Intercultural communication: A reader* (7<sup>th</sup> ed., pp. 75-86). Belmont, California: Wadsworth.

# Ethical Breaches With Educational Technology

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## Introduction

Like most aspects of life, educational technology is multi-dimensional in its relations to people and the environment; educational technology can be good and bad and everything in-between. This group of experienced educational technologists has taken a balanced, honest, and sobering look at people's (including our) uses of technologies for education, and we realize somewhat uncomfortably that often some of our connections to educational technology have questionable consequences for ourselves and/or the people we intend to help. Our connections are ethically questionable. As representatives of the AECT Ethics committee, we have chosen to present (and publish) a discussion regarding these occasions when we have found ourselves involved in ethically challenging situations. Each author's primary aim is to relate an instance when he or she was associated with an ethically questionable or hurtful use of educational technology and, then, to encourage discussion among others regarding that instance or a similar one from their own experience.

Further, each presenter will discuss her or his instance in terms of ethical principles and how the principles should guide educational technologists' work. The ethical principles come primarily from AECT's and AERA's (American Educational Research Association) professional codes of ethics. The idea of iatrogenics (where that which people create to overcome a "problem" makes the problem worse) and the paradox of human consciousness (it hurts as much as it helps) also are used to explain our ethically questionable uses of educational technology.

In terms of the primary aim of this paper, the first author tells the story of the ethical dilemmas encountered as an instructor in intellectual property, when she finds herself dealing with students who violate copyright law in her classes. The next author tells of instances in one school district where she has seen too little being done to offset the fact that technology is promoted without enough thought and conversation among all concerned parties. The final author describes the dilemmas he faces as an educational technology teacher-educator between encouraging pre-service to learn technology skills and technology integration and the technical, pedagogical, and curricular realities that the teachers will face once they are in classroom.

The formal part of our AECT presentation ended with these questions:

- Once you discover that you or someone else is doing harm with educational technology, what should you do?
- If you continue with the status quo, do ethical breaches move from the realm of ethical mistakes that might be forgiven to intentional behavior that requires punishment of some sort?

In our AECT session we each spoke briefly about the examples that follow. We then opened the presentation for discussion, which was lively. Each author remarks on the discussion in the section following his or her example.

## First Example: The Ethical Dilemma Created by Copyright Violations in the College Classroom

My ethical dilemma stems from the muddy world of copyright law. As a faculty member who teaches classes in intellectual property, I am very aware of the many instances of copyright violation that can occur in a college or university setting – especially those among students in my own college classrooms. This comes to a head during assignments, oral and written presentations, many times when I ask for informational materials or media to support a particular belief, argument, or point of view. Invariably, one or two students feel that the best way to support their argument(s) is to take large amounts of factual material directly from one or more sources, copy it, and give each class member a copy. This is often in violation of the Fair Use principles of copyright law and/or without obtaining permission from the owner or creator of the work from which they are borrowing or copying. In most

instances, other than if they are taking or have taken my intellectual property classes, these students have no concept that they are violating copyright law. Additionally, because copyright law is so complex, the other classes I teach do not usually have any aspect of copyright law as part of the curriculum.

Thus, when as an instructor I am suddenly confronted with these violations, I am not sure what I should do. Certainly, this might be a "teachable moment," whereby I go into the whole of copyright and what that particular law means to us as students and educators. However, in most instances, I am not happy with the time that this will take away from the subject of the class in progress. In addition, I also am reluctant to embarrass the student(s) who may be in the process of violating the law as they hand out whole articles, book chapters, etc., sans the permission needed to copy these legally for class. Thus, I find myself in the unique position of realizing that there might be an infringement in progress, but not wanting to put the student on the spot by questioning him/her in the midst of his/her presentation. Also in many instances, such a subject "leap" could redefine the whole atmosphere of the class in progress. Thus, my ethical dilemma is: how much "policing" should a faculty member do in a situation that appears to be within the realm of copyright violation, and yet probably will not go outside the classroom? What about the time needed to change the foci of classes? Should I pursue a subject area that will change the focus of a class, especially if it interrupts student presentations?

### **Solution?**

Given the current foci on intellectual property issues in technology, especially the electronic environment, perhaps the answer to my dilemma lies within my syllabus. By placing a copyright statement in the syllabi of each class, and going over the syllabus at the first class meeting, a short discussion on copyright and violations will automatically be covered. Thus at later dates, should a copyright violation occur, it may be possible to make a statement at the end of the class about how we as students and educators need to observe and follow intellectual property laws. In this way, student presentations and discussion would not be interrupted and a short teachable moment could still occur. What do you think about this dilemma?

### **Second Example: Consulting with a School District**

My ethical dilemma involves the role many of us play in our communities: educational technology consultant to the school district. I have often been asked to provide consultation, training or staff development, serve on technology committees, and so on, in the communities around our university. What this has often meant has not been a "pure" consultation opportunity; it has been, instead, an invitation to help promote or encourage the use of technology in the district, and to help teachers use more technology in their classrooms.

Why is this a dilemma? Isn't helping to promote educational technology a big part of our role? The problem comes for me because I am often not asked to offer suggestions on how best to integrate technology, or which technology to purchase and use. My expertise is requested after the moneys have been spent and the equipment is in the buildings, and teachers are "resisting" using it enough to suit the administration who offered its purchase. I know I am being asked to help promote technology use, to provide staff development on the best ideas for technology integration, and to support the purchase and use of technology already in place. I am not, really, being asked to consult on purchases, or question expenditures, or facilitate discussions with teachers about whether or not they should use technology in their classrooms. That much is clear from the requests I receive. And whether or not these are consultancies for which I am being paid (they usually are not), I feel some responsibility to "give the client what he wants", to provide the service requested.

The dilemma comes from my reluctance to continually promote technology without questioning its appropriate use and the problems that can occur. School district administration professionals are not asking me to help them explore the inappropriateness of a technology purchase, nor are they expecting me to help teachers examine the problems they will probably encounter in attempting to integrate technology. These administrators want to hear the joys and positive effects, not the problems or tribulations of innovation or the possible negative effects on the learning environment of adding too much technology without being prepared. What should I do? How can I take this opportunity to help teachers and administrators, and still have my voice heard, and included the next time? How far should a consultant go in suggesting the reasons that the requested work is answering the wrong questions, or that the solution already identified may create more problems than it solves?

### **Solution?**

The audience at our presentation enthusiastically identified with this problem. Many of them encouraged a similar solution: be prepared to offer your expertise, both sides of the issues, regardless of the original request. Some pointed out that it was impractical not to, since the consultant could be blamed later if an innovation did not work out. “You told us that if we did it this way, learning would improve”, that sort of attack could follow. However, the case example also reminded members of the presentation audience that we have an awesome responsibility as well as the technology skills. We are ethically bound to help people examine their choices and to question the efficacy of the solutions being posed. If we try to “please” by merely teaching teachers, or supporting technology professionals, we are only doing half our jobs. The discussion encouraged us all to consider the long-range use of technology, the problems teachers and students face with technology integration, and to be honest and open about our doubts or reluctance when we are being asked to consult with schools.

### **Third Example: Technology Training and Teacher Education**

My dilemma arises from my role as a teacher-educator of educational technology responsible for teaching the only required technology course at my institution. In this five week summer course I introduce students to a myriad of technical and pedagogical skills including web development, constructing computer-based presentations, creating spreadsheets, evaluating educational software and web sites, using electronic communications like discussion boards, learning Fair Use guidelines and creating technology-infused lesson plans. The course involves a tremendous amount of content and skills building in a short time. In the context of taking this course students are taking a full schedule of other courses as they begin their year-long teacher education program. In short, my students are quite overwhelmed.

I find myself in an ethical conflict as I consider how much information that I should provide my students about the realities of what they may face in the schools in which they will teach. These realities could include:

- computers that are unreliable, out-of -date and that frequently crash
- Internet connections that are slow or inconsistent
- filtering software that blocks sites that they wish their students to visit
- computers that don’t have the software that teachers wish to use or are locked down so that teachers can’t add their own legally purchased software without going through a long, often unsuccessful bureaucratic process
- curricula that is driven by standardized tests and that leave little room for creative uses of technology
- lack of professional-development opportunities related to technology

These are just a few of the roadblocks to using technology that teacher’s may face. In addition to reflecting on how much of this information to provide students, there is also a body of literature about educational technology that is critical of the uses of computers in the classroom. This literature addresses a variety of topics including how technology takes resources away from other aspects of schooling including the upkeep of buildings, how a heavy reliance on technology in education can detract from other ways of knowing and learning, and as the previous example notes how it is not always appropriate to use technology because of various developmental and pedagogical reasons.

What I have encountered in grappling with this dilemma over the years is that delivering too much of the “bad news” and critiques discourages students who are overwhelmed and need to be motivated as they make their way through the course content. Part of how I address this is by informing students of these challenges in a situated manner throughout the course.

In addition to this example, during my presentation I mentioned a similar dilemma that I have in my role as a technology integration trainer for faculty in my college. Because of tremendous administrative and accreditation pressures faculty are being compelled to demonstrate how they integrate technology into their teaching. As a trainer I must always measure how much information that I provide faculty about the amount of technical information that they must learn to implement their ideas. I want to be realistic without being discouraging.

### **Solution?**

In discussing this issue with audience, the consensus emerged that one is obligated to present students and faculty with the full picture. Audience members observed that by providing all the information about

educational technologies that students and faculty can make fully informed choices about whether and how to integrate technology. In general, I agreed with these observations, however this solution did not address for me the issue of motivation in the face of ISTE (International Society for Technology in Education) standards and NCATE (National Council for Accreditation of Teacher Education) accreditation. Technology integration in some institutions is no longer a choice for teachers and faculty, but a requirement for tenure and promotion. The dilemma still remains for me of how to maintain a realistic and critical representation of educational technologies in the face of institutional and societal pressures that discourage us from taking steps away from the forward momentum of technological innovation and diffusion.

## **Conclusions**

Professionals in educational technology, professors of our field, future teachers, and students entering our field, all need to continue to discuss and debate the ethical dilemmas in which we find ourselves. The AECT Ethics Committee encourages all of us to read, understand, consider, and debate the Ethics Statement and to help explore the ethical choices we all make. The AECT website (<http://www.aect.org>) can provide further information on our Ethics and the *TechTrends* column on ethics and other AECT publications can provide further examples of cases for discussion by all of us, especially those of us who are teaching future professional in our field.

# Systems Planning for Faculty Development: Integrating Instruction with Technology

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A process for implementing a faculty development program is described. The goals are integrating instruction with technology and professional development. The model is based on systems planning and draws together learning factors and implementation strategies. Outcomes include understanding the feasibility and critical concerns of this initiative.

The key word in this discussion is “planning.” The field of instructional technology is rich with models and systems for planning or designing that are particularly useful for planning a program for faculty development because the intent of such a program is to be instructional. The organization of this discussion includes five parts: 1) Developing a Vision; 2) Looking at Successful Practice; 3) Implementing the Vision; 4) Realities; and 5) The Future. Pertinent considerations are discussed and relevant models are referenced to help guide the planning for a faculty development program.

## Part 1: Developing a Vision

Imagine your vision of the institution in a few years. See yourself being there. See how faculty development is done. Have a vision. Appreciate the substantive nature of the change in the organization from the current. See real changes that result from effort (Marcinkiewicz, 2001).

Because the implementation of a successful faculty development program requires a change in the organization of an institution, it can be daunting. Knowing that you can accomplish this is the most gratifying part. And, it is a good idea. Perform a short test on yourself, “What would be the consequences if you did not proceed?” See if you would be satisfied with the consequences.

### Goals

There are two goals of this discussion, your appreciation for and understanding of processes that will lead to the institutionalization of faculty development, and the integration of technology with instruction.

### Short History of Faculty Development

Faculty Development programs in higher education are a recent phenomenon. One of the earliest was formed about twenty years ago at the University of Michigan. But there is a reason that development offices have not been commonplace; simply, the absence of development is a reflection of the expectations of higher education on the professorate. Most often professors have been hired because of their expertise in a subject area or because of their researcher. The contradiction is obvious, professors were expected to know something, teaching was either simple enough for an intelligent person to figure out or it was less important than subject expertise or research.

A change in thinking in higher education about teaching, the roles of professors, their preparation for teaching, and their continuing learning about teaching is reflected in the establishment of faculty development programs. One of the motivations for faculty development may very well have been the changed role of students. Students are expressing their expectations of professors one of which is for the professor to be an effective teacher.

There are a variety of names for faculty development programs. They are usually organized as centers and their titles often include one or more (sometimes all) of these terms: faculty, development, teaching, learning, and excellence. In summary, we have come to expect teaching from teachers and we are providing the means for faculty members to learn about teaching until they are done learning, which is to say that they will learn continuously.

## Part 2: Looking at Successful Practice

The first planning tool discussed is a gap analysis that identified the areas to be addressed at my former institution, Ferris State University in Michigan. The program there was the Center for Teaching, Learning, & Faculty Development (CTL&FD). The discussion of the CTL & FD is organized by the structures of a gap analysis: the optimal state, the current state, followed by the response and the outcomes.

### Optimal State—Wanted...

The optimal state included several areas. First, there was a desire for widespread interaction among faculty on a decentralized campus. Second, there was a felt need for increased communication. Third, there was a desire for reflection about teaching. Fourth, there was a need for training for faculty. And, finally there was a need for professional development.

In general, we wanted to communicate and to learn. The gaps reflected the view taken by Peter Senge in the “Fifth Discipline,” that the goal of communication is learning. We wanted to learn and our communication channels were not functioning well.

### Current State—Had...

The current state comprised several areas throughout the university.

The faculty were frustrated with the absence of a means for them to improve or even to establish skills in teaching. Many faculty members were directly hired from business and industry and so unlike their colleagues who were hired from other academic institutions, they were not even familiar with the setting. Both sets of colleagues did share a lack of preparation for teaching.

There was a sense of fragmentation at the university that was evidenced by activities that were occurring at one college that had relevance for the entire institution but were not known by members outside of the college.

There had been proposal for a faculty development program which was a reflection of pent-up demand for learning. These are the artifacts of a functioning system that was not acting cohesively.

### Response—Did...Structure...

The Office of the Vice-President for Academic Affairs approved the establishment of the CTL & FD. These are some of the structural elements that were introduced.

### Varied schedules of activities

Commonly available times (“holy hours”). Thursdays from 11 AM to 1 PM had been a part of the existing schedule reserved for university-wide activities such as faculty development. The CTL & FD encouraged adherence to the schedule.

Training sessions were scheduled for short and long periods. Some sessions lasted three to five days. We favored very short sessions lasting fifty minutes that focused on a single concept and which were repeated several times. The aim in scheduling was to offer as many opportunities for attendance as possible, in other words, to be accommodating to the widely varying schedules of faculty members.

### Special interest groups

We actively made the acquaintance of faculty members sometimes directly visiting offices to introduce ourselves in an effort to build awareness for the activities of the CTL & FD and to learn about the interests of faculty members. These activities led to the formation of special interest groups that were supported by the CTL & FD with coordination of meeting times and places and the provision of refreshments. Some groups that formed included interests such as public speaking, web development, grant writing, and scholarly writing.

### Individual consultations

The interactions between the CTL & FD staff and the faculty were not only in workshops or group meetings, we also scheduled individual consultations with professors as well as meetings with entire departments.

### Faculty as facilitators

There was variety among our presenters as well. The richest pool was from the faculty itself. In fact, faculty appreciated very much the opportunity to learn from each other.

### Response—Did...Philosophy

We listened carefully and often to faculty members and our practices were true to learner-centered philosophy in an iteration referred to as “Progressive Education.” We ensure that the teaching is tailored to the needs of the learner and we provide opportunities for the faculty-learner to practice during the instruction. The philosophy of our practice is faculty-as-learner-centered development.

The CTL & FD enjoyed an independent status and was not affiliated with any of the colleges, but rather reported directly to the office of the vice-president for academic affairs. As with any effective instruction, we tried to follow up on any activities that we offered. For example, if a person participated in a workshop on syllabus preparation, he or she was asked to be available to advise colleagues. Or, sometimes we would simply send an e-mail message asking whether the workshop helped or continued communication with the individual.

Response—Did...Incentives...

The well-established rule about incentives is that they must be the appreciated by the receiver in order to be valued and motivating. With faculty members, money was not the primary incentive. We tried a variety of financial incentive plans, and large amounts of money did not seem more desirable than a nominal sum that would be considered a professional honorarium. When asked, faculty members first sought the learning; any tokens of recognition were appreciated if they expressed a value for the faculty as professionals. One requisite that was universally effective was the provision of food. Another incentive for faculty especially at institutions that are decentralized is the opportunity to meet their colleagues which helps to build esprit de corps. Perhaps the primary incentive for faculty to continue learning is their innate love of learning. Faculty members are, after all, educators. A final practical point is that participation in development activities counted towards promotion and tenure and post-tenure review consideration.

Response—Did...Activities...

The CTL & FD organized its activities in three main areas mirroring those conducted by Centers around the country as suggested by the Professional and Organizational Development network.

Professional development

This category of activities focuses on the career of a professor such as mentoring, grant writing, scholarly writing, promotion and tenure.

Instructional development

This category of activities focuses on teaching and learning including instruction, assessment, learner characteristics, and instructional media.

Support of the institution

This category of activities focuses on the professor participating in and understanding the system of the institution, including its mission, history, town and gown relationships, the community, and the personnel makeup of the institution.

Achieved...

The faculty and the CTL & FD together achieved very active participation and growth in programming.

- 70% participation rate  
There were over 450 full-time tenure track faculty members who were organized in a collective bargaining unit for which there was no mandate to participate in faculty development activities. Reporting of statistics like these were facilitated by the database created for recording our activities. It served us well when we reported to three accreditation agencies.
- 11% in 15-week courses  
One example of participation was the over-capacity sign up for 10 and 15 week CTL & FD led courses.



- 97% -ile of worldwide users of WebCT  
The demand for a web presence was explosive and faculty driven. Once a course management system was introduced, faculty members sought training and were productive in delegating some of their instruction to the system.
- Hesburgh certificate of excellence  
The CTL & FD was awarded TIAA-CREF's award for a program aimed at developing undergraduate faculty to improve student learning.
- Distributing our services  
The CTL & FD began to train faculty at area institutions.
- Exemplars for other institutions  
We communicated with several institutions to advise about setting up programs.
- 80–90% faculty satisfaction rating  
The CTL & FD enjoyed high approval ratings on university-wide surveys.
- Goal of continuing learning  
The strong support by the faculty was an indicator of progress toward the goal of continuing learning.
- Yearlong transition program for new faculty  
An accomplishment was the initiation of a highly successful program for new faculty.
- No indifference  
It was very gratifying that the mood on campus lacked indifference. There was strong and expressed interest among the faculty.

### **Part 3: Implementing the Vision**

The discussion about establishing a program at your institution is organized by the structures of a gap analysis similar to Part 2, the optimal and current states, but implementation steps are described at length. The conditions are all assumed but considered to be very likely.

#### Optimal State—Wants...

Because of the universal interest in these two areas among institutions of higher education, it can be assumed that your institution would also be want to operate a faculty program for professional development and instructional development.

#### Current State—Has...

The appraisal of the actual state at your institution reveals that the following conditions exist. There is motivation, limited funding, and an estimated retirement of 50% of your faculty within the next 10 years. These are fairly safe assumptions and reflect the reality of most institutions of higher education.

#### Implementation—Can Do...

Use instructional system design strategy to organize your planning especially because your focus will include instruction. There are a variety of models available and in general it is probably less important which model you use than that you do use a model to keep track of your thinking. These well known planning activities organize this discussion about implementation: assess, design, develop, implement, and evaluate. Bear in mind that while, they are presented in sequential order, untoward conditions may affect the order in which you may actually be able to conduct planning. Try, however, to establish your evaluation methods and techniques to be congruent with the objectives you establish.

It is assumed that you would have conducted a process to determine your needs and that was described in the previous section detailing the results of a gap analysis. The next processes in which you would engage are design and evaluation.

#### Design Steps...Objectives

The following is an example of suitable objectives for a faculty development program.

- Learn about your field
- Learn about teaching & learning
- Serve the institution
- Reflect upon teaching
- Understand students
- Engage in scholarship

The following is an example of suitable objectives for a development program that also serves staff and administration. Recall that traditionally higher education administrators come from faculty ranks and do not have formal training in management or leadership.

- Learn about the field
- Learn communication technology
- Serve the institution

It is important to focus on the ultimate objective of any faculty development program, that is, the development of students. Example objectives for students include...

- Improved learning
- Retention

It is also important possible and desirable to identify objectives for the institution. Example objectives include...

- Competitiveness
- Retention of faculty & students
- High Esteem
- Esprit de Corps

#### Design Steps...Evaluation

Some purposes of evaluation are to gauge whether your program is meeting its objectives and what factors or conditions are contributing to its operation. To facilitate your assessment and evaluation processes, it is recommended that you establish a database that includes your activities as well as the various units of your institution and the members of the faculty. Gather data counts of participants but also count repeat participants. For example, there may be two activities with 10 participants, but they may be the same 10 individuals. It is desirable to know whether the participants are the same or not. Consider various quantitative and qualitative measures.

As part of your evaluation process, count your failed activities as well as your successful ones. Make plans for what you will do as your activities succeed or fail to meet your objectives.

A valuable practice to introduce for your faculty is the Small Group Instructional Diagnosis (SGID) procedure (Clark & Redmond, 1982). This simple procedure is conducted early in the semester in the absence of the professor. It is a kind of focus group activity intended to get early and candid feedback from the students. It can be effective and is inexpensive. We assess using the SGID format after each of our activities, then annually we do a more detailed survey. Assessment is a burden and intrusion and so we limit our use of them. Try to use varied other formats to gather information. Use phone calls or face-to-face conversations to get input from faculty. Note how often and for what reason a faculty calls the senior administration; it must be pretty urgent for a call to be made to senior administration

#### Design Steps...Planning Considerations

As part of the design process it is recommended to consider four factors affecting learning. These were suggested by Jenkins (1979) and Bransford (1979): media, assessment, the learners' characteristics, and instruction.

#### Media

These are pertinent questions to consider.

- What media will you use?

- Who or what will deliver instruction?
- What media are available to you?
- What do you currently use?
- What can you not use?
- What is your institution's plan for providing equipment to faculty, for classrooms, for web-enhanced instruction, for complete online instruction?

#### Learners' Characteristics

You need to consider you're the faculty and staff administrators and their needs as a group, as subgroups, and as individuals. Some guiding questions are...

What are their particular needs?

- Who are faculty?
- How are people in the academy unique?
- Are there characteristics particular to members of the institution?
- Are they similar to academics in CA (diverse) or NV (from many areas and newly arrived)?
- Who are managers and administrators?
- To what kind of information do they respond?
- Emphasize practical over theoretical pedagogy.
- People outside of a field tend to lack the interest and the preparation to participate in a theoretical discussion at length.
- Low ceilings in faculty career
- Build steps into the career path. Consider starting a senior learning community. See the work of Milton Cox at Miami University, Ohio.
- Administrators often untrained in mgmt.

#### Characteristics of Faculty Members and Other Academics

- Highly intelligent
- Love of learning
- Strong sense of collegiality

Ask...

- How would you characterize academics as compared to airline personnel, or the military?
- What are their career expectations?
- Why would they want to learn more?

#### Instruction

Methods of instruction need to be considered. After all, the learners must do something in order to learn. What will they do? How will you orchestrate the activity so that it is effective? These are guiding questions...

- In what activities will they engage?
- What scheduling tactics? Formats? Instructors?
- What methods?
- How will you pace the activities.

#### Instruction—Best Practices

Some practices that worked well at the CTL & FD included the following...

- Learning communities. Focus on activities that demand communication and collegiality. Remember the strong sense of collegiality among academics.
- Learner-centered instruction: customize and demonstrate learning(Progressive ed.)
- Collegial activities...panels. Allow the faculty to practice, often. Customize the training to meet their needs.

- Patience & non-threatening practice. Allow faculty, adult learners, time to learn and many opportunities to practice.

## Content

The questions that will guide planning for content are...

- What do faculty need to know about?
- What do administrators need to know about?

## Faculty

Just as you, the planner of instruction for faculty need to consider four factors of learning, so do your faculty need to learn about, understand and address four factors of learning in the instruction that they plan and implement. Once again, four factors of learning are media, assessment, instruction, learners' characteristics, administration, & advising

## Administrators

For administrators focus on three elements of leadership: management, team-building, and creating the future. These are suggested by Sullivan and Harper in their book, "Hope is Not a Method," in which they discuss how the armed forces were reorganized from dealing with predictable conditions to unpredictable conditions.

## Part 4: Realities

You may still be wondering, "Is this all possible?" Gilbert (1978) has suggested three areas that must be accounted for if competence is to occur. In this case, these conditions need to be addressed in order for faculty development to occur. The areas are contributed to externally by the institution and internally by the individuals aspiring to competent behavior.

The Model of Competence suggests the external and Internal provisions of the following conditions:

- Motivation & Incentives
- Equipment & Ability
- Information & Understanding...and training

In application, the model can be completed as follows. The institution provides incentives, equipment, and expresses expectations. The individual becomes motivated, adapts for competency, and learns.

- Costs
- There are a variety of costs involved.
- Effort
- Personnel
- Time
- Restating the mission

Not all costs are directly financial.

One cost in restating the mission may be the most motivating: giving value to the learning that professionals do.

## Part 5: The Future

Your endeavor may result in the following...

- Unique program
- Change in way of life
- Achieved goals

Several models relevant to planning a faculty development program were discussed in the context of an instructional design model. The discussion followed a sequence from developing a vision to looking at past practice to implementation to reality checks to the future. Some points that deserve restating: a faculty development program requires an institutional change, the implementation requires a vision as well as effort as would be expected of any successful and rewarding effort. To paraphrase a chief of the Oglala Lakota Native Americans, "...vision with work is only a dream; work without a vision is a drudgery, but together they can change the world...."

## References

- Bransford, J.D. (1979). *Human Cognition: Learning, Understanding and Remembering*. pp. 6–9, Belmont, CA: Wadsworth Publishing.
- Clark, D., & Redmond, M. (1982). Small group instructional diagnosis: Final report. University of Washington, Seattle. FIPSE. ERIC Document Reproduction Service. No. ED 217 954.
- Gilbert, T. F. (1978). *Human competence: Engineering Worthy Performance*. New York: McGraw-Hill Book Company.
- Jenkins, J. J. (1979). Four points to remember: A tetrahedral model of memory experiments. In Cermak, L.S., & Craik, F.I.M. (Eds.), *Levels of Processing in Human Memory* (pp. 429–446) Hillsdale, NJ: Lawrence Erlbaum Associates.
- Marcinkiewicz, H. R. (2001). The Role of Centers of Teaching and Learning in Integrating Technology in Instruction. *The Technology Source*. <http://ts.mivu.org/default.asp?show=article&id=863>
- Senge, P. (1990). *The Fifth Discipline*. New York: Doubleday.
- Sullivan, G.R., & Harper, M.V. (1996). *Hope Is Not a Method*. New York: Broadway Books

# Collaborative Cultural Studies over the Internet; Learning Cultures with Virtual Partners

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## Introduction

*“Culture is a complex, abstract, and pervasive matrix of social elements that functions as an all-encompassing form of pattern for living by laying out a predictable world in which an individual is firmly oriented.”*

Richard Porter & Larry Samover

Offering a predictable world and orienting students in that controlled environment offer the faculty a new level of challenge. Technology makes this task possible. The ultimate goal of this project challenges us to create and provide a communicative environment in which is most natural to L2 and C2<sup>14</sup>. We seek to teach in the world where the instructors and students coexist in non-artificial simulation.

The computer-assisted classroom is no longer a simulation, but a real life. The idea of “Learning can be undertaken in state-of-the-art classrooms, but can also be integrated into the living arrangements” (Gilman) is obsolete. In 21<sup>st</sup> century life, our lives globally connect to each other with technological network. The networked life is the living life. In that environment, one of the most important issues is the understanding of L2 and C2 to make successful communications.

Since the fall semester of 1995, students at Baylor University taking Japanese and students at Tokyo Institute of Polytechnics have had opportunities to communicate each other and learn together at in a real-world situation. Until the fall 2000, the format limited them to e-mail communication. Today, we have begun a new adventure in learning culture and communicating appropriately with the colleagues from the other side of this planet using other Internet tools.

## Software and Hardware Used

Communication software, iVisit, utilizing web-based camera provides an instant visual, oral, and aural transoceanic communication along with text chat. This method brings a classroom halfway across the globe next door. We use this web-based free-of-charge software in the introductory and concluding discussions. Due to our hardware limitation, each school used one web-based camera.

FirstClass offers students to communicate in the manner of a bulletin board service. It allows students to leave messages, possibly enhanced with graphical and audio files, anytime of the day from anywhere in the world. It allows students to read the postings and share ideas. Contrary to iVisit, FirstClass gives time to students to think and examine what to post. The client software is free-of-charge and supports many different platforms and languages.

## Criteria

For this study, Baylor University selected the parameter range of students to be 3<sup>rd</sup> semester, 150 contact hours, or higher. Tokyo Institute of Polytechnics has selected students from Intercultural Communication Studies who have been studying English for at least 6 years. Students from both universities interacted in L1 and L2 to complete the task.

## The Project Time Table

### 1. Introductory iVisit session

At the end of September 2000, the first iVisit session took place. Baylor class met at 7p.m. to accommodate the time difference of 14 hours. Students answered Pre-Project questionnaires to examine what

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<sup>14</sup> L1 is the first language and L2 is the second language. C1 is the culture of the students own, and C2 is the culture which student is learning as the second culture.

technological and cultural experiences they have had and how those experiences will change them at the completion of the project.

During this one-hour introductory session, instructors shared the intention and schedule of the project first. Then many students took the opportunity to introduce themselves and asked some questions such as weather, fashion fads, popular music, politics, and other current events. Some questions were prepared and others were spontaneous.

## **2. Research in C1**

The myth exists among Japanese that folks in Texas still use horses as the main transportation and chases and feeds livestock all day. Then there is a myth among people in the U.S. that Japanese still walk around with katana swords in their sash and drink sake with geisha girls. Although such misunderstanding exists, students have very shallow understanding of their own culture to help others understand the truth. Therefore we assigned students to research in C1 to deepen their knowledge before learning C2 any further. Japanese students took the subject of bushi/samurai while U.S. students researched cowboys.

Due to the great number of students involved in this project, the students were divided into six groups; history, jobs, appearances, life style, culture, and beliefs and spirits. By mid October 2000, students posted their research results in assigned rooms on FirstClass server in Tokyo. We chose students to post their messages of C1 in L1.

## **3. Read in L2 and learn C2, then post**

Students read the posted messages in L2 and learn C2. Then they are required to post a response, including a question, in the mixture of L1 and L2 by the end of October 2000. The interface of FirstClass is very similar to that of many popular email applications. Therefore, it is user intuitive and user friendly.

## **4. Read and post in the mixture of L1 and L2**

By middle of November 2000, students have read the comments and questions toward their research. These comments and questions required further research in C1. By this time the communications are getting less formal. Students are developing healthy friendship within their small groups. We encourage students to correspond as much as they prefer.

## **5. Concluding iVisit session**

At the beginning of December 2000, we conducted a farewell iVisit session. Students from U.S. met at 6 p.m. to accommodate the time difference. (A cultural lesson, meeting time in U.S. changes by one hour since there is no Daylight Saving Time in Japan.) The excitements fill the both rooms to meet their cyber friends from their small groups and finally put the name and face together. Students filled the Post-Project questionnaires consisting 44 questions, to complete this project.

## **Five C's**

*"Culture is not the people but the communication that links them together."*

Mary Jane Collier

Our goal is to see how students can learn C2 through their communication in more realistic way through technology. In order to complete this approach, we must consider and examine the Five C's and apply this idea to enhance learning.

In the first C, *communication*, we use iVisit to encourage and enhance students' speaking and listening skills. In contrast, during FirstClass sessions students mainly applied their reading and writing skills. Many students enhanced their FirstClass presentation with visual and aural communication tools, such as sound and graphic files to deepen the communication.

As mentioned earlier, this project is not only learning C2, but begins from examining C1. This enables the complete reflection and learning of *cultures*. Examining and understanding oneself only enhances understanding

others. FirstClass sessions allowed students to examine the myth and find the truth. iVisit sessions filled students' appetite with better understanding of contemporary popular culture.

As students learn another culture in a language class, there is an opportunity to make *connections* to other academic fields. The following chart indicates some of what students had shared and learned throughout the project.

	iVisit	FirstClass
Politics	Discussion of contemporary agenda	Political system from the appropriate era.
History	N/A	Cowboys and Samurai
Music	Discussion on contemporary music	Music that cowboys and samurai listened.
Art	Contemporary fashion fads.	Paintings depicting the appropriate era were shared.
Literature	N/A	Appropriate literatures were shared.
Sociology	Experiencing such traits as tardiness and shyness of students make a reflection to its culture.	Fashion, jobs and other related issues were discussed.

From entire project students received opportunities to make *comparisons*. One way is to compare and contrast now and then. It is done in different subject fields, which we discussed previously as a part of connection. Comparison of C1 and C2 within the particular time occurs concurrently. These comparisons take place during both iVisit and FirstClass sessions.

<i>Then</i>	<i>C1</i>	< >	<i>C2</i>
	^		^
	v		v
<i>Now</i>	<i>C1</i>	< >	<i>C2</i>

To provide *Communities*, we used iVisit for its visual, oral, and aural communications. This community was a large community where students shared one camera, one microphone and one screen. FirstClass clients were more intimate. It used small groups for the reading and writing communities. Individual involvement became more crucial in this exercise. Yet we realize that a true global community evolves during the project. Both software can be used from anywhere in the world.

These five c's take significant part of this project. Each c depends on each other to make this collaboration effective. Only when these five c's become interactive, this project claims success.

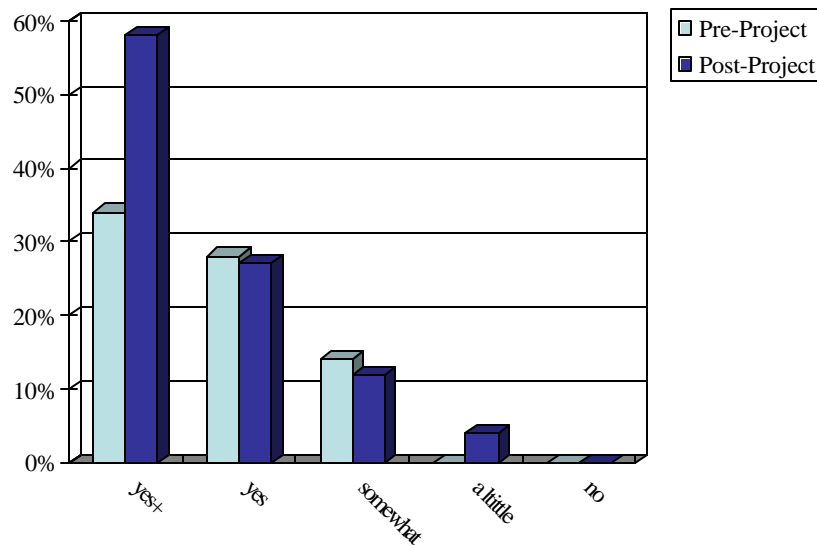
## Data

Since the first semester, all of the targeted Baylor students have already been assisted on their language acquisition by computers from their "E-mail Penpal" programs. However, their change in opinion and attitude toward computer-assisted-learning has not yet been measured until now. Students have and will complete two questionnaires for this collaboration. One must be taken before the project and the other immediately after completion of the project.<sup>15</sup>

<sup>15</sup> Questionnaires are available for the viewing purpose only at <http://www.baylor.edu/~Japanese/interculture.html>.

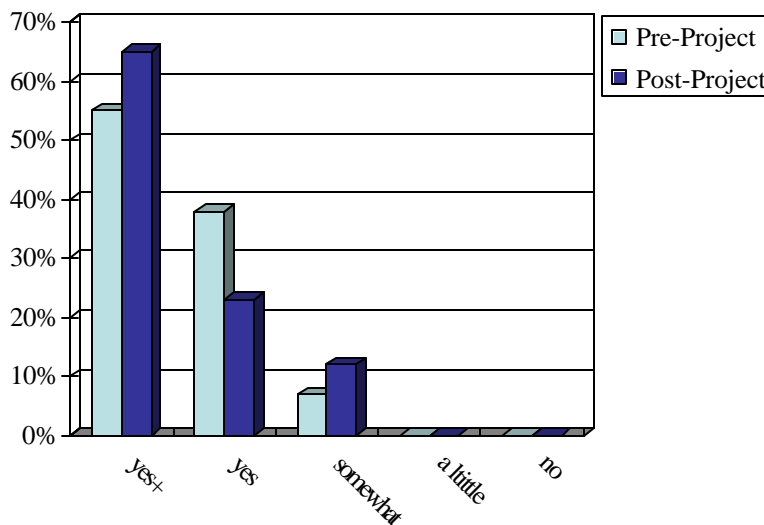


Although current result limits in accuracy to determine its outcome from the data of only one project, preliminary data result from Baylor students show the effectiveness of computer-assisted acquisition. In asking,



“Do you think computer is a useful learning tool in academic setting?” clearly there is an increase in recognizing the usefulness and effectiveness in application of technology in education during one semester.

Another interesting question asked, “Are you interested in foreign cultures?” The interest in foreign cultures increased after experiencing this collaborative project. Therefore, as predicted, the technologically enhance culture-learning collaboration place learners in positive and predictable communicative world in which learners must experience to acquire another culture.



On the Japanese side, the questionnaire results show no statistically significant change of attitudes among students. However, quite a few post project comments from these Japanese students tell that they became able to perceive their virtual partners as real persons and build a kind of relationship that promotes learning. The

*importance of personal relationship for network-based learning programs has been suggested by several Japanese researchers, and this study meets such a claim.*<sup>16</sup>

### **Problems to be solved**

As with any project, we can expect some problems. The problem, which we cannot resolve, is the time difference during iVisit sessions. 14 or 15 hours in time difference, depends on the Daylight Savings Time, becomes a menace. Another problem in iVisit session is the poor connection speed. The poor connection speed will result in jerky and dropped video and audio feed. Another result of the poor connection speed is the extreme reverberation of audio feed which disables the recognition of the language.

Limitation in the number of video windows forces us to use only one camera. It would be ideal to have all 30+ students to appear in individual windows. But software issue and connection speed limits us to perform at that level yet.

In FirstClass neither the time nor connection speed raise serious concern. The limitation in number of students who can login simultaneously brings a serious concern. This problem disables to login to FirstClass server as an individual during a class and has discussion on particular postings.

### **Conclusion**

After all, “*when we are merely being ourselves, acting according to our deepest instincts, human being reveal fundamental differences in what we all tend to think of as normal behavior.*” (Storti) Communication errors easily and rapidly occur in our networked life. Strangers from all over the world gather in the online community. Without proper understanding of cultures, the behaviors progress inappropriately.

Five c’s take an important role in teaching culture in foreign language courses. In the acquisition of language and culture, the technology assists teachers to offer innovative and effective method of educating. Technology aids *communication*, assists to learn *culture* of L2, make *connections* with speakers of the target language, provides *comparisons* between L1-L2 and C1-C2, and offers to participate in *communities* using languages other than L1.

### **Reference**

- Collier, Mary Jane. “Cultural Identity and Intercultural Communication.” Intercultural Communication. New York: Wadsworth Publishing Company, 1996. 36-44
- FirstClass - <http://www.softarc.com/>
- iVisit - <http://www.ivisit.com/>
- Porter, Richard & Larry Samover. “An Introduction to Intercultural Communication.” Intercultural Communication. New York: Wadsworth Publishing Company, 1996. 5-26
- Rauch, Jonathan. The Outnation. Toronto: McGraw-Hill Ryerson, 1992
- Storti, Craig. Cross-Cultural dialogues. Yormouth: Intercultural Press, Inc., 1994
- Gilman, Sander L. “Learning a Foreign Language in a Monolingual World.” Publication of the Modern Language Association of America 115 (2000): 1032-1040

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<sup>16</sup> The importance of relationship building for network-based corroborative learning is discussed in the following books and the article.

Saeki, Y., Fujita, H., and Sato, M. Eds. (1996), *Manabiau Kyoudoutai* (The Community for Learning Corroboratory), Tokyo: University of Tokyo Press.

Mima, N. (1997). *Fushigikan Network no Kodomotachi* (Children of Fushigikan Network), Tokyo: Just System

Okubo, M (2000), “Learn and Express through the Internet” Proceedings of the Sixth Joint Conference on Educational Technology, pp. 873-874. : JCET 2000, Naruto, Tokushima, JAPAN.

# Selection of learning tasks based on performance and cognitive load scores as a way to optimize the learning process

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## Abstract

*To attain highly efficient instructional conditions, it is important to adapt instruction to the individual trainee. This, so-called, personalisation of training by dynamic/automatic task selection is the focus of the present paper. Recently, cognitive load measures have been proposed as a useful addition to conventional performance measures like speed and accuracy. The combination of conventional performance measures and cognitive load measures can be used to obtain information about the mental efficiency of instructional conditions. We argue that the dynamic/automatic selection of learning tasks on basis of mental efficiency will have a significant influence on the optimization of the learning process.*

## 1. Introduction

People are faced with increasingly demanding working environments in modern society. The time constraints are increasing and task environments are getting more complex. People have to master complex working skills quickly and efficiently, because training time is often limited and mistakes can lead to dangerous situations and high costs, especially in technical domains such as aviation and industry. One way to meet these requirements is to create more efficient training by personalizing instruction

The primary goal of this article is to argue that task selection based on mental efficiency optimizes the learning process. Mental efficiency is a combined measure that uses information on performance measures and cognitive load measures (Paas & Van Merriënboer, 1993). Existing Intelligent Tutoring Systems (ITS) only use performance measures as a determinant for task selection. Although cognitive load sometimes is measured, it is not used as a determinant for task selection

In this article, we will first give a review of various task selection approaches. We make a distinction between static and dynamic task selection approaches. In both procedures the training is based on the trainee's prior knowledge. However, the selection of a set of learning tasks can either be chosen by the teacher/trainer prior to the start of the training (static procedures) or can be adjusted during the training (dynamic procedures).

It has been proposed that when teaching student complex cognitive skills, part-task training can have a higher learning efficiency and reduced training costs than whole-task training (Wightman & Lintern, 1985). We will use the whole-task and part-task approaches as subcategories for static and dynamic selection, yielding four approaches. These are static whole-task approaches, static part-task approaches, dynamic whole-task approaches, and dynamic part-task approaches. Then a new approach using mental efficiency in a dynamic whole task procedure will be presented. Finally, we will discuss this approach.

### 2.1 Static whole-task selection approaches

The elaboration theory (Reigeluth & Stein, 1983) states that one should start with the simplest kind of typical task that an expert would perform and to gradually progress to more complex tasks. All the tasks in the training are whole-tasks. Furthermore, the sequence of the tasks in the training is preset before the training.

The elaboration theory makes a distinction between task expertise and domain expertise. Recently, a new approach, the Simplifying Conditions Method (SCM), for building task expertise has been developed. It offers guidance for analyzing, selecting, and sequencing the learning tasks. Given that any complex task has some conditions under which it is easier to perform than under others, a SCM sequence begins with the simplest version of the task that is still fairly representative of the task as a whole. Then it gradually progresses to more complex versions of the task until the desired level of complexity is reached, making sure that the learner is aware of the

relationship of each version to the other versions. Each version of the task is a class or group of complete, real-world performances of the task (Reigeluth, in press).

Another new approach, called the familiarity approach, uses the prior knowledge (familiarity) of the trainees and the difficulty of the tasks to base the training sequence on (Scheiter, Gerjets, & Tack, 2001). The first lessons or parts of a training contain high familiarity and are of low difficulty. As a learner progresses through the lessons or training, familiarity decreases and difficulty increases.

The SCM and the familiarity approach share many aspects. Both approaches, rightfully, claim that the training should be adjusted to the prior knowledge of the trainee. After having correctly performed a task of a low complexity, the complexity is gradually increased during the training. Note however, that the training has been preset and the sequence of the tasks in the training is not subject to any change. These approaches do not adapt to the needs of the individual trainee. They only adapt to the prior knowledge of a target group and not specifically to each individual learner before the training starts.

## 2.2 Static part-task selection approaches

Wightman and Lintern (1985) have proposed that when teaching students complex cognitive skills, part-task training can have a higher learning efficiency and reduced training costs than whole-task training. Segmentation is one of the three of methods of task decomposition that were discussed and evaluated by Wightman and Lintern (1985). Segmentation involves partitioning a whole task into components along spatial or temporal dimensions. Prior to the training the size of these components is adapted to the prior knowledge of the trainee.

A well-known method of segmentation-based training is backward chaining, in which the last component of a task is practiced first and earlier components are introduced later in the training (Proctor & Dutta, 1995). Benefits of backward chaining in comparison to whole-task training may originate from the role of knowledge of results (KR) in learning (Wightman & Lintern, 1985). Wightman and Lintern (1985) have suggested that, as a result of training, the perceived competency in performing the final task component can act as KR for the preceding components, thus facilitating learning of earlier components of the task.

Ash and Holding (1990) found that forward chaining, in which the order for adding task components is first to last, was more effective for learning selective keyboarding skills. Forward chaining may sometimes be superior to backward chaining because in this method task component-completion feedback is always proximal to the component task being introduced (Proctor & Dutta, 1995).

An approach that is linked to segmentation is the blocked versus random scheduling approach. These part-task sequencing methods have been contrasted with each other in numerous studies (e.g., Carlson & Yaure, 1990). The random schedule contained four rules intermixed from trial to trial within practice blocks, compared to the blocked schedule that contained only a single rule appearing repeatedly with each practice block. It was found that acquisition performance for a set of individually presented component skills was better when the components were practiced in a blocked schedule than in a random schedule. However, retention and transfer performance was better following a random practice schedule. These results have been replicated by Lundy, Carlson, and Paquiot (1995). Their explanation for this finding was that random practice provides a richer set of cues for distinguishing among the items in a set. This results in more accurate retrieval of a particular item from long-term memory. The richer set of cues is another way of saying that the variation was higher. They furthermore reasoned that rule-specific processing occurred in the blocked schedule and that relational processing occurred in the random schedule. Rule-specific reasoning emphasizes the need to reconstruct rule-like procedures in working memory. Relational reasoning emphasizes the opportunity to compare multiple representations, thus making relations, in working memory. These two processes resemble the rule automation and schema acquisition processes that were identified by van Merriënboer and Paas (1990).

The hierarchical approach that was developed by Gagné (1968) also is a static part-task approach. It is based on the observation that a skill is made up of simpler “component skills” that you must learn before you can learn the larger, more complex skills of which they are a part. Gagné distinguished five intellectual skills that are increasingly detailed and difficult. At the bottom level there are discriminations, followed by concrete concepts and defined concepts, at the next level there are rules and at the top level there are high-order rules. The hierarchical arrangement of these five skills helps one to figure out what the prerequisites a given skill might have. To make sure the learner is not confronted with learning tasks of skills that (s)he already has mastered, the training needs to be started at the level of “entering knowledge” of the learner. A hierarchical sequence is one which never teaches a skill before its prerequisites (Gagné, 1968).

All three approaches, rightfully, claim that one should adapt the training to the trainee’s prior knowledge. And like the hierarchical approach states, some skills should be learned before a trainee can start to learn a more

complex skill. However, none of the approaches allows adaptations to the individual trainee to be made during the training.

### **2.3 Dynamic whole-task selection approaches**

The last decade, dynamic approaches have been widely used to adapt more efficiently to the needs of the individual trainee. It is possible to respond to the learner's problems during the training, with decisions being made that are typically based on the performance of the trainee.

In order to keep track with the trainee's history of the tasks and the correlating performance, many ITS (Intelligent Tutoring Systems) use a student model. A student model builds a knowledge base of the trainee, and updates that knowledge as the trainee progresses through the tasks of the training. Certain learning objectives have been specified prior to the training, which are used to check the progress of the trainees. Performance measures are collected and are compared to the learning objectives. After this comparison, the selection rules indicate the next learning task to present to the learner.

However, many approaches focus on elaborating the operationalization of student modelling while not being clear on the selection rules that are being used. These approaches include psychometric approaches (for a discussion, see Everson, 1995), agents (e.g., Capuano, Mersella, & Salerno, 2000; Giroux, Leman, & Marcenac, 1995), and fuzzy logic (e.g., Virvou, Maras, & Tsiriga, 2000). Mostly, the primary function of student models is to give specific feedback to the learners about their performance. An ITS that explicitly describes the selection rules that are being used is CASCO (Completion Assignment Constructor). CASCO is an ITS for the dynamic construction of assignments to practice introductory programming (Van Merriënboer, Luursema, Kingma, Houweling, & De Vries, 1996). Based on different actions of the trainee, CASCO can decide whether the trainee has learned the programming skill or not, can adjust the amount of presented information by increasing or decreasing information in the completions tasks, and decide to either delete or add the program code, explanations, questions, and instructional tasks (Van Merriënboer, & Luursema, 1995).

CASCO uses several straightforward selection rules. The most important rule states that a good problem is suitable to present new learning elements and to practice known learning elements. CASCO could therefore be classified as a Progressive Mental Model (PMM). The other rules state that a good problem is not too difficult, has not been presented to the learner before, and is suitable to remediate learning elements the learner makes mistakes with. While the learner is working on an assignment, student diagnosis takes place in order to update the student model. The learner's results on questions and instructional tasks form the input of student diagnosis. For all learning elements that have already been presented to the learner, the so-called Expertise and Incompetence are computed (Van Merriënboer, Krammer, & Maaswinkel, 1994). Expertise indicates the learner's proficiency in correctly using a particular learning element, while Incompetence indicates the learner's tendency to make errors with a particular learning element. For each learning element, the Expertise and Incompetence are further modeled as fuzzy sets. The truth value of the membership of those sets may range between 0 and 1. To keep track of the students' progress two sets have been developed. The Learning Set, which contains the learning elements that the learner is already practicing but has not mastered yet. And the Incompetence Set, which contains the learning element that the learner is already advancing in but still makes mistakes with (Schuurman, 1999).

It is common for ITS to base their student model and task selection on performance measures like speed and accuracy. We argue that it is important to use mental effort as an additional determining factor because different students can attain the same performance level with different amounts of invested mental effort.

### **2.4 Dynamic part-task selection approaches**

The first dynamic task selection approach, in a very raw version, was branching. This part-task approach attempts to diagnose the learner's response, usually on the basis of a multiple-choice question. The training starts with offering pieces of information and during the training more information is added with each next step until the trainee reaches the state where the whole task can be performed. This process is also known as snowballing (van Merriënboer, 1997). After the learners have been presented a certain amount of information, they are given a multiple-choice question. If they answer correctly, they branch to the next body of information. However, if they are incorrect, they are directed to additional information, depending on the mistake they made (Clark, 1997). The amount of branching may vary considerably, from occasional branch points to branching after every student's response. Branching can be based on individual performances, cumulative performance, or student choice. The direction of branching can either be forward, sideways, or backward. Forward means that the learner skips

information that most students see. Backwards means that the learner is returned to repeat instructions. And sideways means that the learner is exposed to extra information that most learners skip (Allesi & Trollip, 1991).

Most of the research on branching has been done in the 1960s and 1970s. Although the theoretical foundation is good and makes sense, the practical part of proving the superiority of branching over normal fixed sequencing appeared to be difficult. There are several studies that showed evidence in favor of the branching sequence over a fixed sequence (Coulson, Estavan, Melaragno, & Silberman, 1961; Hurlock, 1972; Slough, Ellis, & Lahey, 1972), but most studies fail to show a superior effect of branching (Campbell, 1962; Glaser, Reynolds, & Harakas, 1962; Holland & Porter, 1961; Lahey, 1973). It was stated that the Computer Assisted Instruction programs usually consisted of a simple algorithm for branching among a few fixed alternative questions. Such rigid plans do not provide a model of how a tutor can adapt the generation of tasks to suit the particular needs of each student (McArthur, Stasz, Hotta, Peter, & Burdorf, 1988). Furthermore, the costs and time needed to complete a part-task training are mostly very high.

### **3. The use of mental efficiency in a dynamic whole-task selection approach**

Our approach incorporates various elements of the discussed task-selection approaches. Like in the whole task approaches we start with the simplest version of a whole task. The complexity of the training should be adjusted to the trainee's prior knowledge. In other words, the familiarity should be at an appropriate level. All the versions of a whole task are categorized in learning tasks which gradually increase in complexity in respect to each other. The trainee starts with the lowest complexity and proceeds to the highest complexity, while the pace of the progression depends on performance and cognitive load measures. Like in CASCO (e.g., Van Merriënboer, Luursema, Kingma, Houweling, & De Vries, 1996) we can adjust the amount of information that is presented to a learner. Dependent on the learner's performance and load, the information can be decreased, kept constant, or increased. Furthermore, as in the dynamic approaches we can select learning tasks during the training and adjust to the individual learner's needs during training.

Another characteristic of the approach is that instead of presenting more whole tasks, it can be more efficient to present part-task training for the part of the task that the trainee has not mastered yet. Consider for example learning how to drive a car. If a trainee has mastered steering skills, gas-and brake skills but still has not mastered the shifting gear skill, then this skill should be practiced in isolation until the required performance level has been reached. With part-task training of this component the costs in terms of cognitive capacity will decrease and the learner will be able to acquire the whole task more efficiently.

Cognitive load has been acknowledged as an important factor in the training of complex cognitive skills. When learners acquire simple skills, cognitive load only plays a minor role. A badly designed training does not necessarily have negative effects because learners can invest mental effort to compensate for the bad design. However, when learners are presented with a training of complex skills, they are not able to do anymore. They do not have mental effort for this purpose because the training generates a high cognitive load upon the learner's capacities. Students can attain a high performance but with varying amounts of load. By taking cognitive load into account the decision in task selection can lead to optimal individual learning. Learners attain the highest performance when they have to invest an optimal amount of load. Therefore, we propose to use performance measures in combination with mental effort measures for dynamic task selection. A procedure for combining mental effort and performance measures in a measure of mental efficiency was described by Paas and van Merriënboer (1993). The efficiency measures take differences in cognitive capacity, expertise, and motivation into account. The use of mental efficiency is expected to make the individual training more efficient, and to lead to better transfer results.

A first confirmation for this claim was found in a study conducted by Camp, Paas, Rikers and van Merriënboer (2001). They compared four methods of task selection in the domain of air-traffic control. Learning tasks could be presented in a fixed order from simple to complex, or the selection could be based on performance, mental effort, or the combined measure of both, mental efficiency. Although, they did not find differences in transfer performance as a function of learning task selection method, the results showed that participants in the mental efficiency condition were confronted with high variability of learning tasks, and that participants in the performance condition were confronted with low variable learning tasks.

We believe that our approach is a promising one. It takes more information about the learner's learning progress into account than the conventional approaches. Mental efficiency combines performance measures and cognitive load measures on which the task selection decisions are based. Furthermore, tasks can be presented in different formats to the trainee. Dependent on the mental efficiency of a previous task, the decision can be made whether the learner support can be decreased, kept constant or increased. The variability is high, which means that

trainees will be exposed to various analogies that induce schema acquisition. Because of the higher training efficiency, trainees participating in our approach should also be able to reach better results on transfer tasks. We are currently developing more experiments to obtain more evidence for the expectation that our approach indeed leads to more efficient individualized training.

#### 4. Discussion

The goal of this article was to argue that task selection based on mental efficiency is a promising approach for optimizing the learning process. In order to reach this goal, we first gave a review of various task selection approaches. We made a distinction between static task selection approaches and dynamic task selection approaches. Within these main approaches, a distinction was made between whole-task and part-task approaches. The resulting four approaches were static whole-task approaches, static part-task approaches, dynamic whole-task approaches, and dynamic part-task approaches. The static whole-task approaches including the familiarity approach (Scheiter, Gerjets, & Tack, 2001) and the elaboration theory (Reigeluth & Stein, 1983) claim that the training should be adjusted to the prior knowledge of the trainee. After having correctly performed a task of a low complexity, the complexity is gradually increased during the training. Our main critic on the static aspect was that the training has been preset and the sequence of the tasks in the training is not subject to any change. In this situation it is impossible to optimally adapt to the needs of the individual trainee, especially during training.

The static part-task approaches, including segmentation (Wightman & Lintern, 1985), blocked vs. random schedules (e.g., Lundy, Carlson, & Paquiot, 1995) and the hierarchical approach (Gagné, 1968), showed that part-task training can be useful at some occasions. However, because of its high costs and long duration, we propose to use part-task training only as an additional part of whole-task based training. The static aspect of the part-task approach also was criticized for its inability to adapt efficiently to the learner's needs during training.

Dynamic whole-task approaches including Intelligent Tutoring Systems (ITS) have been focussing on the operationalization of selection rules. Many articles describe the functionalities of their student models in great detail but do not explicitly describe the selection rules that have been used. CASCO was identified as an exception to this rule. Our main critic on dynamic whole-task approaches was that they only use performance as the determining factor for task selection. We argued that cognitive load can provide additional information about the learning progress of a trainee.

Dynamic part-task approaches including branching (e.g., Campbell, 1962) were the first to try to diagnose the learner's response. However, the programs that used branching usually consisted of a simple algorithm for branching among a few fixed alternative questions. This does not enable one to efficiently adapt to the particular needs of each student (McArthur, Stasz, Hotta, Peter, & Burdorf, 1988).

Instead, we suggested a mental-efficiency based dynamic whole task procedure with the possibility for additional part-task training. Task selection is based on a combined measure of performance measures and cognitive load measures called mental efficiency. Furthermore, the sequence of the learning tasks is not preset but is dependent on the mental efficiency of the individual trainee. It is important to adapt instruction to the individual learner to attain efficient instructional methods. Preliminary evidence for the success for the use of mental efficiency in dynamic task selection was found in the study of Camp, Paas, Rikers and van Merriënboer (2001).

#### 5. References

- Allesi, S.M., & Trollip, S.R. (1991). *Computer-based instruction: Methods and development* (2nd ed). Englewood Cliffs, New York: Prentice-Hall.
- Ash, D.W., & Holding, D.H. (1990). Backward versus forward chaining in the acquisition of a keyboard skill. *Human Factors*, 32, 139-146.
- Camp, G., Paas, F.G.W.C., Rikers, R.M.J.P., & van Merriënboer, J.J.G. (2001). Dynamic problem selection in air traffic control training: a comparison between performance, mental effort and mental efficiency. *Computers in Human Behavior*, 17, 575-595.
- Campbell, V.N. (1962). *Studies of bypassing as a way of adapting self-instruction programs to individual differences*. San Mateo, California: American Institute for Research.
- Capuano, N., Marsella, M., & Salerno, S. (2000). ABITS: An Agent Based Intelligent Tutoring System for *distance learning*. In C. Peylo (Ed.), *Proceedings of the International Workshop on Adaptive and Intelligent Web-based Educational Systems held in Conjunction with ITS 2000 Montreal, Canada*. Osnabrück: Technical Report of the Institute for Semantic Information Processing, 2000.

- Carlson, R.A., & Yaure, R.G. (1990). Random practice schedules and the use of component skills in problem solving. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 16, 484-496.
- Clark, D. (2000). Development phase. In *Instructional system design* (Chap. 4). Retrieved from <http://www.nwlink.com/~donclark/hrd/sat4.html>
- Coulson, J.E., Estavan, D.P., Melaragno, R.J., & Silberman, H.F. (1961). *Effects of branching in a computer controlled auto-instruction device* (Report No. TM-617). Santa Monica: System Development Corporation. (ERIC Reproduction Service No. ED002306)
- Everson, H.T. (1995). Modeling the student in intelligent tutoring systems: The promise of a new psychometrics. *Instructional Science*, 23, 433-452.
- Gagné, R.M. (1968). Learning hierarchies. *Educational Psychologist*, 6, 1-9.
- Giroux, S., Leman, S., & Marcenac, P. (1995). Representing organisational student models: A generic concurrent coordination. Paper presented at the Montreal ITS'96 workshop. Retrieved from <http://advlearn.lrdc.pitt.edu/its-arch/papers/leman.html>
- Glaser, R., Reynolds, J.H., & Harakas, F. (1962). *An experimental comparison of a small-step single track program with a large-step multi-track (branching) program*. Pittsburgh: Programmed Learning Laboratory, University of Pittsburgh.
- Holland, J.G., & Porter, D. (1961). The influence of repetition of incorrectly-answered items on a teaching-machine program. *Journal of the Experimental Analysis of Behavior*, 4, 305-307.
- Hurlock, R.E. (1972). *Applications of pretest branching design to CAI basic electronic training* (Report No. SRR-73-8). San Diego: Naval Personnel and Training Research Laboratory.
- Lahey, G.F. (1973). *Post lesson remediation and student control of branching in computer based training* (Report No. SRR 73-19). San Diego: Naval Personnel and Training Research Laboratory. (ERIC Reproduction Service No. ED083797)
- Lundy, D.H., Carlson, R.A., & Paquiot, J. (1995). Acquisition of rule application skills: Practice schedules, rule types, and working memory. *American Journal of Psychology*, 108 (4), 471-497.
- McArthur, D., Stasz, C., Hotta, J., Peter, O., & Burdorf, C. (1988). Skill-oriented task sequencing in an intelligent tutor for basic algebra. *Instructional Science*, 17 (4), 281-307.
- Paas, F.G.W.C., & van Merriënboer, J.J.G. (1993). The efficiency of instructional conditions: An approach to combine mental-effort and performance measures. *Human Factors*, 35, 737-743.
- Proctor, R.W., & Dutta, A. (1995). *Skill acquisition and human performance*. American Psychology Texts: Sage Publication.
- Reigeluth, C.M. & Stein, R. (1983). Elaboration theory. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: An overview of their current status*. Hillsdale NJ: Erlbaum.
- Reigeluth, C.M. (in press). *Scope and sequence decisions for quality instruction*.
- Scheiter, K., Gerjets, P., & Tack, W.H. (2001). *The impact of problem order: sequencing problems as a strategy for improving one's performance*. Unpublished manuscript, Saarland University, Saarbruecken, Germany.
- Schuurman, J.G. (1999). *On the proper treatment of learning and transfer. A study on introductory computer programming*. Doctoral dissertation. Deventer, Drukkerij de Bruijn bv.
- Slough, D.A., Ellis, B.D., & Lahey, G.F. (1972). *Fixed sequence and multiple branching strategies in computer assisted instruction* (Report No. SRR-73-6). San Diego: Naval Personnel and Training Research Laboratory. (ERIC Reproduction Service No. ED074707)
- Van Merriënboer, J.J.G. (1997). *Training complex cognitive skills: A four-component instructional design model*. Englewood Cliffs, NJ: Educational Technology Publications.
- Van Merriënboer, J.J.G., Krammer, H.P.M., & Maaswinkel, R.M. (1994). Automating the planning and construction of programming assignments for teaching introductory computer programming. In R.D. Tennyson, R.D. (Ed.), *Automating instructional design, development, and delivery* (NATO ASI Series F, Vol. 119, pp. 61-77). Berlin: Springer Verlag.
- Van Merriënboer, J.J.G., & Luursema, J.J. (1995). Implementing instructional models in computer-based learning environments: A case study in problem selection. In T.T. Liao, T.T. (Ed.), *Advanced educational technology: Research issues and future potential* (NATO ASI Series F, vol. 145). Berlin: Springer Verlag.
- Van Merriënboer, J.J.G., Luursema, J.J., Kingma, H., Houweling, F., & De Vries, A.P. (1996). Fuzzy logic instructional models: The dynamic construction of programming assignments in CASCO. In R.D. Tennyson, R.D. & A.E.B. Barron, A.E.B. (Eds.), *Automating instructional design: Computer-based development and delivery tools* (NATO ASI Series F). Berlin: Springer Verlag.



- Van Merriënboer, J.J.G., & Paas, F.G.W.C. (1990). Automation and schema acquisition in learning elementary computer programming: Implications for the design of practice. *Computers in Human Behavior*, 6, 273-289.
- Virvou, M., Maras, D., & Tsiriga, V. (2000). Student modeling in an Intelligent Tutoring System for the passive voice of English language. *Educational Technology & Society*, 3 (4). Retrieved November 23, 2000, from [http://ifets.gmd.de/periodical/vol\\_4\\_2000/virvou.html](http://ifets.gmd.de/periodical/vol_4_2000/virvou.html)
- Wightman, D.C., & Lintern, G. (1985). Part-task training for tracking and manual control. *Human Factors*, 27 (3), 267-283.

# Towards the Transformation of Higher Education: Educational Technology Leadership

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## Abstract

*This paper focuses on the management and change domains of educational technology, namely the need for educational technology (ET) leadership in higher education. Leadership issues are examined with respect to instructional development, faculty development, and instructional technology/media management in higher education and the roles ET practitioners can play. Other topics include: a description of the transformative process underway in higher education driven by technological innovations; raising awareness of the need for ET practitioners and doctoral students to aspire for administrative leadership positions for effective policy formulation, strategic planning, management, evaluation, and implementation of instructional development; and discussion of the essential skills and strategies for achieving ET leadership in colleges and universities.*

*We are in favor of ET professionals going beyond providing basic services or merely running equipment distribution units. We advocate leading the change in instructional development, technology integration in the learning process, managing resources and effectively collaborating with faculty in designing instruction. We advocate for positions that will permit the ET professional to work with institutional leaders in policy-making and in planning for instructional technology deployment, faculty development, and instructional development.*

*The term ET professionals is used to refer to individuals with formal training in the field of educational technology, instructional technology, instructional media, instructional systems, educational communications and all related areas, and who have work experience in the field.*

## Introduction

“The real question is not whether higher education will be transformed but rather *how* and *by whom*.” —James J. Duderstadt (1999)

The emergence of new technologies led by the popularity of the microcomputer and the ubiquitous nature of communication technologies has brought significant changes to the field of educational technology (ET). These changes are acutely felt in higher education, where Duderstadt (1999) envisions a significant transformation during this decade as colleges and universities respond to their internal changes (Katz, 1999) and the needs of a rapidly changing society (Surry, 1996; Surry & Robinson, 2001). Some notable changes in higher education include: requirements for all students to own laptop computers; incentives for professors to integrate technology into their courses; wireless network campuses; and classrooms equipped for multimedia learning. Technological innovations, in general, are not new, but the accelerated rate of change is moving towards a knowledge-driven future for which many colleges and universities are struggling to prepare.

The rapid changes in technological innovations we are witnessing all around us today are affecting educational institutions and are fundamentally changing the educational needs of society (Surry, 1996). There seem to be the lessening of the initial resistance to the adoption of the new technologies in higher education. The effects of the change induced by the technological innovations in higher education are becoming obvious. Change is not a new phenomenon as most organizations go through such experiences. Change in higher education is inevitable and as Duderstadt (1999) pointed out “the real question is not whether higher education will be transformed but how and by whom”. The change, in part, is brought from the outside by technological forces (Daft, 2001). As noted by Siegel (1999) and Doll (1993), higher education is a complex and chaotic social system. The complex nature of higher education has affected the manner and method of adopting the new innovation. Equally, the influence of technological innovations has affected the way business is done in higher education. Some of the areas that have been impacted by the innovations are, faculty training in the use of technology in teaching, innovative learning with technology, and the management of technology in higher education. Administrators in higher education are doing their best to manage the change process.

Faculty are key stakeholders in the adoption of educational technologies since the changes brought about by such innovations affect either the way students learn or how instructors teach. Campus officials have consistently rated assisting faculty with technology integration as one of the most important information technology issues challenging higher education (Green, 2000). Units that support faculty in their instructional roles, such as audio visual services, instructional media centers, faculty development centers, and centers for teaching excellence, are also undergoing changes in organizational structure, technologies, and functional operation to meet the emerging needs of an educational technology powered campus. Administrators within these units are facing dual challenges to manage a dynamic change process and handle the educational technology innovation. Fullan (1993) and Sparks (1993) assert that leaders in educational institutions need to understand the change process in order to effectively lead and efficiently manage the transformation currently underway. To assist both faculty and administrators in this process, ET practitioners can provide leadership in the adoption and use of technology for the improvement of teaching practice and learning processes.

### **ET professionals in the field**

In a speculative article on the roles of educational technology practitioners in the year 2000, Bratton (1988) wonders if there will be many in this field who will rise to leadership roles. Surry and Robinson (2001) found that many colleges and universities are actively recruiting for positions that require educational technology skills. While most of those positions are for instructional technologists, a few are at a high level of ET leadership, such as director, dean, or vice president of an academic computing unit. Surry (1996) reports that educational technologists are steadily being hired in higher education and in a recent study by Surry and Robinson (2001) they categorized numerous current educational technology job postings. Albright (1995) also reported that administrative positions in higher education are being advertised. This is unprecedented and could be attributed to the technology revolution. However, an important question is, are these positions, particularly those for senior managers, directors, deans, and assistant vice president positions, being filled by ET professionals?

### **Who is leading?**

Many graduates of educational technology programs who hold the master's or doctorate degree seem to take up positions as instructional designers or faculty teaching positions in colleges and universities with titles such as: Instructional Technologist; Instructional Designer; Distance Learning Co-coordinator; Instructional Technology Manager/Administrator; Technical Support Specialist; World Wide Web Specialist; and Instructional Technology Librarian (Surry & Robinson, 2001). As a consequence, the early periods of technology revolution saw them still in their "traditional" roles rather than taking up positions to direct or influence the adoption of innovation in higher education. Such roles are non-agenda setting (Surry, 1996). This is not to say that the positions they hold are inadequate for leadership, however, they may be limiting in terms of the influence they have in directing educational policy issues and in influencing change. The current roles held by ET practitioners can be the starting point for advancement to higher-level administrative and policy-setting positions that provide platform for greater influence on the transformation of higher education.

The technology revolution has created the need for educational technologists in almost every sector of the economy including higher education. Albright (1995), comments that, "in fact we are seeing significant evidence of administrative recognition (with) position announcements for a director or dean to administer a composite of campus-wide educational technology services" being advertised. That is good news for practitioners in this field. Additionally, Surry (1996) reports that educational technologists are being steadily hired in higher education; however, the responsibilities, functions, and qualifications required for these roles are not properly defined. The same question remains, are these positions being filled by ET professionals? While these positions are being advertised, it will be interesting to find out if they are being filled by ET graduates or otherwise by faculty members from different disciplines. Anecdotal evidence suggests that many individuals filling these positions have not had the academic training in educational technology. Faculty from other disciplines seem to dominate administrative leadership and management roles regarding instructional development within colleges and universities, as well as faculty development areas. The implications are that decisions and policies regarding technology integration in the classroom, helping faculty to improve teaching, and the instructional development process across all academic disciplines in higher education are not made by those trained in educational technology.

Wright (1997) found in a study of faculty and instructional development programs in higher education that leaders in these areas seem to emerge from the faculty ranks, irrespective of their primary academic discipline or previous experiences. The study confirms the notion that the appointments to such leadership positions are usually

filled by faculty, who are prepared as specialists in their various fields with little or no training in leadership, technology use, and in the process of teaching and learning (Bates, 1999; Noone & Swenson, 2001). Most are not trained as educational technologists. Therefore, faculty appointments to top ET positions may be the result of a long-standing perception of the roles of ET practitioners by faculty and higher education administrators. Whereas faculty have maintained a strong position as leaders in academic matters, ET practitioners are perceived as providing services to support instruction (Heinich 1995). There seems little room for faculty to negotiate or share the roles. Administrators in higher education do not appear to have demonstrated enough understanding of the roles or potentials of ET professionals.

### **The Need for Leadership**

At any level, there remains a significant role for an educational technology leader in higher education to guide faculty innovations, work collaboratively with faculty and administrators, and lead the efforts towards educational technology change in higher education. As the transformation progresses, faculty need training in the skills that are essential for teaching and learning and with technology, support during the development process, and advice for the effective integration of media and information technologies. While a few ET practitioners in colleges and universities have advanced to leadership positions, entrenched institutional policies and practices unique to higher education present challenges to overcome (Bates, 1999; Green, 1999; and Duderstadt 1999).

A survey of instructional development, academic technology, faculty development, and media services programs in higher education reveals a need for leadership and management of these programs. It does appear that a problem that Spitzer (1987) raised (reported in Galbraith et al, 1990) still persists. Spitzer identified three factors he “believes explain why educational technology has not achieved its potential.” One of the reasons he identified was the leadership problem, that is, the dearth of people who will lead to moderate the “quagmire of individuals, groups, and interests that claim a part share in the educational technology enterprise”. He noted that a major managerial/leadership gap has not been bridged. Seels and Richey (1994) describe management as one of five domains of the instructional technology field. Galbraith, et al. (1990) add that, “The successful application of technology in education depends not so much on the technology, but how it is managed” A recent study by Johnson (2001) that looked at issues in academic technology leadership in higher education found few ET professional in top leadership positions. Bates (2000), who visited several colleges and universities during a study, states this case precisely and succinctly, “In all the organizations that I visited where technology was being used successfully for teaching, strong leadership was a critical factor. Without leadership and a strong sense of support for change in an organization, the barriers of inertia will be too great”.

Effective management of the instructional development process and technologies used in instruction, and the preparation of faculty, will likely result in the efficient use of the technologies, and in the improvement of both teaching and student learning processes. Management implies leadership and by virtue of their placement in leadership positions, ET practitioners are advantageously positioned as change agents, especially as it relates to the use of technology in instruction. As a result of their preparations and understanding of educational systems change, instructional systems approach, and knowledge of learning technologies, educational technologists can exert considerable influence through technology in reshaping educational settings. Roberts (1994) argues that technology and educational reform or restructuring is “inexorably” linked and that merely deploying technology in schools cannot cause educational reform. The changes called for cannot occur in isolation or by simply acquiring new technologies. In the higher educational system, change is best implemented from within. There is need in education for systemic thinking as the newer technologies are introduced. Introducing innovation and managing change in higher education, we believe, requires individuals who have established credibility within the institution; understand the idiosyncrasies of academic environments; support the role and use of technology; respect the instructional design process, and possess skills in change.

The focus here is on leadership. We do recognize the importance of management functions and other roles that ET professional play, they are all essential for the success of the learning enterprise. While management and leadership seem synonymous, we have emphasized leadership, as many seem to agree that it provides a broader perspective, fosters a holistic view on issues, enlarges vision, engenders viewing issues from systemic point of view, and provides better opportunity for change sponsors and agents for the betterment of the organization, and such that will appeal to the organizational stakeholders. The leader directly or indirectly influences and motivates individuals with inspiring examples. Leaders are expected to shape the culture of an organization by creating new visions. Kearsley and Lynch (1994) add that the success of leaders is determined by their ability to understand and influence organizational cultural mores and values. When followed, the course that the leader charts will ultimately profit the

organization, and in this case higher education. Management, though equally good, tends to focus on details in their work environments and to compartmentalize.

### **Unique Qualities of ET Professionals**

We do believe that by the nature of their training and experience, ET practitioners can work well with faculty in improving instruction in higher education, as well as working effectively to manage educational technology change in higher education. ET practitioners can work well as change sponsors, change agents and change advocates in initiating and implementing change in higher education. Rather than be seen as encroaching into the faculty domain of instructional delivery, they can co-exist as partners in the effort for instructional development and integration of technology in instruction. To better address this issue will require an understanding of the preparation, roles, function, and abilities of the ET practitioners in instructional development and managing change. Their training focuses on instructional design and development, media use in instructional or performance improvement, educational and learning theories, technologies of instruction, as well as educational systems design. Some programs are adding change management, organizational development, and management courses. These skills equip them to view issues systemically and holistically, and to provide the appropriate interventions.

### **The Educational Technologist: A Change Agent for Higher Education**

This seems to be the right direction for higher education in its efforts to either manage or implement successful technological change initiatives. People who are familiar with higher education seem to view the issue from the same perspective. Bates (2000) advocates that the best approach for colleges and universities is to create the position of “associate vice president, academic, with overall responsibility for academic technology issues, probably as part of a larger unit for teaching and learning.” This position will collaborate with the information technology group and similar on-campus organizations to manage instructional technology, administer faculty training, and design instruction for better student learning. Dillon and Walsh (1992) identify leadership as the foundation on which change rests. Kearsley and Lynch, (1994) summarize, “Technology leadership is inherently linked to innovation and this provides unique consideration. While leadership usually involves dealing with change, technology leadership deals almost exclusively with new procedures, policies, and situations”. They identified the potential benefits of good technology leadership, that includes, “improved academic achievement by students, improved student attendance and reduced attrition, better vocational preparation of students, more efficient administrative operations, reduced teacher/staff burnout and turnover”. An addition to the laudable list is better support and training for faculty. For educational technology leadership, having a clear vision of how the educational technology innovation would be adopted to produce the desired changes for the maximum benefit of the institution is an essential requirement. The implications for the ET practitioner is that only when they aspire for and move into such leadership positions can they wield the necessary influence that will support the better adoption of new technologies that will have profound impact in the teaching and learning process in higher education.

### **Aspiring for Leadership Positions**

It behooves ET practitioners to strive for the leadership positions when such positions become available. A content analysis of recent position announcements in higher education confirms other findings (Albright, 1995; Wright 1997; Surrey and Robinson, 2001; Johnson, 2001) that leadership positions are gradually opening up. As stated previously, ET practitioners hold a small proportion of the positions. Romiszowski (1994) points out that as educational technology practitioners, we have a great deal of experience in evaluating and designing systems for patrons and little experience in designing for ourselves. It appears, from current trends and the positions many practitioners hold, that many of those in leadership are not playing the sponsor role in the change process. As Salisbury and Conner (1994) point out, “to successfully champion change in education, advocates must first realize that they cannot initiate change until they have obtained sponsorship. Advocates without sponsors result in conferences and good intent but not substantive change”.

Being in the right leadership position will permit the ET practitioner to function not only as change agents and advocates, but also play the role of change sponsors. The advantage of being a sponsor is that it puts the practitioner in direct control to initiate change. A change sponsor is, “a person or group who has the authority and legitimizes a change” (Lick and Kauffman, 2001). Further, the change agent is a person or group who is responsible for implementing desired change. Examples in higher education include: chancellor, VP, Dean, program/division

director, among others. Lick and Kaufman (2001) advocate that leaders need to provide and implement “a detailed, structured, disciplined transition plan for identifying and completing the major change”.

The roles that ET practitioners seem to have played for a long time are the roles of change advocates and targets. As advocates, they train and encourage faculty and others to use technology. As targets, they change or reposition themselves with any wave of technology for pedagogy that is in vogue. In these roles, they have lacked the authority to initiate, plan, implement, and evaluate technological change in the teaching and learning environment, in part because they are not playing the sponsor role in the change process.

For educational technology leadership, possessing a clear vision of how the educational technology innovation would be adopted to produce the desired changes for the maximum benefit of the organization is an essential requirement. Kearsley and Lynch (1994) add a perspective that the success of leaders is determined by their ability to understand and influence organizational cultures. The role of a leader is more than management of resources. As opposed to a manager, who may tend to be compartmental in their operation, the leader is more holistic and tends to view issues from a systemic perspective. Leaders are expected to shape the culture of an organization by creating new visions for organizational improvement in such a manner that will appeal to the key stakeholders. The implication is that when the ET practitioner assumes this kind of leadership position, they can then utilize the necessary influence to support effective adoption of educational technology systems in higher education

## **Moving into Leadership**

### **Implications**

The dual role of ET practitioners in instructional design and leadership comes with added responsibilities and calls for additional sets of skills (e.g., project management, consulting, change management) that may not be a component of the ET graduate curriculum and new knowledge domains not usually associated with educational technology (e.g., administration in higher education, educational leadership, educational theory and policy). With the necessary preparations, educational technologists can exert considerable influence through technology in reshaping educational settings.

Moving into leadership positions as they become available requires preparation on the part of the ET practitioner. Although they possess the basic skills as a result of their training, ET professionals constantly need to update their skills especially for management and leadership in order to align themselves to the opening positions. The need for constant update of skills and for the acquisition of new skills is essential in view of the constantly changing dynamics in today’s work environment, including higher education (Gilliland and Tynan, 1997). This calls for change in behavior in those aspiring for leadership or administrative positions in ET to transcend the acquisitions of traditional skills and competencies for instructional designers and reach for the skills that will propel them to leadership positions. Both practicing ET practitioners and those graduating from ET programs need to be cognizant of the requirements for the new leadership positions and to prepare accordingly.

It must be mentioned that moving up to the leadership positions will have its challenges and obstacles. Such positions are often fraught with politics and thereby requires understanding and adaptation to the organizational culture (Rossett 2000). As Creth (2000) observes, “Unlike deans, department heads, and faculty in academic programs, administrators in non-academic service areas...do not enjoy the protection of tenure as they cope with the inherent risks of change.” However, the problems are not more challenging than being in supervisory or non leadership positions that lack the provision of sufficient resources to discharge their duties and protection from the consequences of working in a complex environment.

### **Benefits**

Much benefit accrues with ET professionals moving up into leadership positions. The institution, faculty, students, and the ET professionals will all mutually benefit. The processes that are likely to be put in place will better advance the missions of the respective institutions. As stated earlier, technology adoption efforts, faculty development issues, and instructional development process will be approached from systemic and holistic standpoints. Policy issues regarding these areas will involve those that understand the ramifications of the policies in the area, as well as implications of wrong policies. This will help to foster better relationship among campus groups involved in the use technology in the teaching and learning process.

## **Recommendations: Preparing for educational technology leadership**

Before assuming any leadership role, the educational technology practitioner must be adequately prepared with a broad array of interpersonal skills and abilities in management and leadership (Surrey, 2001). Academic or professional preparations beyond the usual boundaries of educational technology should include topics in: organizational change and theory; higher education administration; educational theory and policy; workforce education; and management science and theory.

### **ET programs**

To better prepare students to meet the new demands, educational technology programs may need to focus on those skills that will equip graduates to assume leadership roles and function better in higher education. In addition to the requirements in preparing students for faculty positions, a track may need to be established. Courses that will help students develop the requisite skills in leadership, management and understanding of organizational set ups (Rossett, 2000), change management, educational systems design, and project management. Surrey and Robinson (2001) also suggest that for those interested in positions in higher education, technological and interpersonal skills are very much desired. Some of these could be achieved by collaborating with other departments/programs to offer relevant courses or to organize workshops and seminars. These will not be added to the detriment of the core instructional development focus of the programs. Rather, it will be in addition to all those competences that have been the hallmark of educational technology programs.

### **ET Students**

Students in ET programs who desire to move into leadership positions upon graduation may begin early in their programs to prepare. In addition to taking relevant courses, they need to be familiar with current positions, job descriptions and entry requirements as they prepare. They need to have the traditional competencies for educational technologists. It will be helpful to stay current with trends and to position themselves for the desired positions.

### **ET Professionals**

This will lead to the expansion of the roles of ET professionals. It will result in moving from service support roles to roles that will be involved in looking at instructional and technological problem holistically. To be in a better position to be successful and to handle the challenges, ET professional will need to be prepared. Some of the possible ways to prepare include being involved in professional development, going for an advanced degree if necessary, supporting current superiors, being current, having a vision and a plan for the new career direction, and staying current in the field. Try your hands on playing leadership role before your friends and others whenever the opportunity calls. The old art of networking should not be neglected. This is not an exhaustive list but a beginning guide for the professionals.

### **Conclusion**

Higher education is changing by gradually responding to the change brought about by technology and other related forces. Colleges and universities have a distinctive culture that characterize or define them. Equally, units within the organization, which could be described as subsystems, exhibit distinctive culture that is a result of their profession. Change resulting from adoption of learning technology will evidently affect change in other areas because of the interrelatedness of the various subsystems and the complexity of higher education as a social system. Such intricate and complex process needs to be addressed by professionals who understand the systems and can provide a holistic intervention. It is our view that ET professionals can help higher education significantly in this era of transition.

Many institutions have invested heavily in information technology, and as a result questions about the effectiveness of technology are being asked. During the period of acquiring technologies, many institutions did not have any policies or any instructional technology plan. In the early days of the new media, many institutions did not seem to have any plans as to what technologies are needed and how to use them in instruction. A lesson to be learned is that merely acquiring assorted technologies does not translate into good instruction. Equally, using technology in an adjunct or desultory manner may not achieve the desired learning outcomes. Having a sound technology plan and working with faculty to redesign instruction to accommodate the new delivery systems, under the leadership of ET professionals will be beneficial in enhancing the teaching and learning process as well as

advance the mission of the institution. With the properly prepared ET professional in place, higher education will be on the road to realizing the promise of technology in this evolving era in education.

The increased involvement of ET professionals in educational technology leadership as well as other service areas will help higher education as it strives to enhance faculty teaching, and technology skills, and consequently improve student learning. The need for the preparation of leaders in educational technology is encouraged by current trends that suggest that some in the field are making inroads into the leadership and management cadre. Educational technology practitioners are gradually advancing in position, heading ET departments and holding other administrative positions.

It is hoped that this paper will draw the attention of ET practitioners, faculty, and students to the necessity to strive towards leadership positions in higher education. Educational technology graduate programs may in response develop specializations in higher education leadership and management. Increased numbers of ET trained administrators and faculty with interest in ET leadership in colleges and universities would be a boost to the field. The technological transformation of higher education will proceed regardless of whether ET practitioners are leading the change. It would be beneficial for all stakeholders in colleges and universities if ET graduates assume the leadership positions that make key decisions that, in turn, influence future generations of college graduates, ET practitioners, and hopefully faculty, who continue the cycle.

ET leaders will also help in seeking and selecting the right ET professionals who are well prepared to meet the needs of the institutions. A look at many job announcements for instructional technologist/designer position seems to emphasize more on hardware and software skill, and less, sometimes, no instructional design skills are listed. This may probably be symptomatic of the lack of understanding of the roles and functions of ET professionals and the sets of skills and competencies they bring along. ET professionals in leadership can help to address such problems, as well as work towards the standardization of job descriptions for ET positions.

## References

- Albright, M. (1995). Media centers and instructional technology in an era of information technology. *Media Review*, Fall 1995.
- Bates, A. W. (1999). *Managing technological change: Strategies for college and university leaders*. San Francisco: Jossey-Bass Publishers.
- Bratton, B. (1988). Roles for educational technologists by the year 2000. *Journal of Instructional Development*, Vol. 11, No. 3.
- Charchian, R. and Cohen, S.L. (2000). It's your move: Playing a new game as training professional. *Performance Improvement*, Vol. 39, No. 7.
- Creth, S. (2000). Optimizing Organization Design for the Future. *Educause Quarterly*, No. 1.
- Daft, R. L. (2001). *Essentials of organization theory and design (2nd ed.)*. Cincinnati, OH: South-Western College Publishing.
- Dillon, L.C. and Walsh, M.S. (1992) Faculty: The neglected resource in distance education. *The American Journal of Distance Education*, Vol. 6, No. 3.
- Doll, W. (1993). *A Post-Modern Perspective on Curriculum*. New York: Teachers College Press.
- Duderstadt, J. J. (1999). Can colleges and universities survive in the information age? In Katz, R. (ed.) *Dancing With the Devil: Information Technology and the New Competition in Higher Education*, Jossey-Bass, San Francisco, CA
- Fullan, M.G.** (1993). *Change Forces: Probing the depths of educational reform*, Bristol, PA: Falmer.
- Galbraith, P.L., Grice, R.D., Carss, L.E., and Warry, M. (1990). Instructional technology in education? Whither its future? *Educational Technology*, August 1990.
- Gilliland, M. W. and Tynan, A. (1997). Leadership and Transformation in an Environment of Unpredictability. *CAUSE/EFFECT*, Vol. 20, No. 3, pp. 30-31, 51-58.
- Green, K. (1999). "The continuing challenge of instructional integration and user support." *The campus computing project*.
- Heinich, R. (1995). The proper study of instructional technology. In Anglin, G. J. (Ed.), *Instructional Technology: Past, Present, and Future*, Englewood, CO: Libraries Unlimited.
- Katz, R.N. (1999). *Dancing with the devil: Information technology and the new competition in higher education*. San Francisco: Jossey-Bass.
- Kearsley, G. & Lynch, W. (1994). (Eds.) *Educational technology: Leadership perspectives*, Englewood Cliffs, NJ: Educational Technology Publications.



- Lick, D.W., and Kauffman, R. (2001). Change creation: The rest of the planning story. *Planning for Higher Education*, Winter 2000-2001.
- Noone, L.P. & Swenson, C. (2001). Five dirty little secrets in higher education. *EDUCAUSE Review*, 36(6), 20-31.
- Romiszowski, A. (1994) In Kearsley, G. & Lynch, W. (Eds.) (1994). *Educational technology: Leadership perspectives*. Englewood Cliffs, NJ: Educational Technology Publications.
- Roberts, L. G. (1994). An interview. *Technos*, vol. 3, No.1, pp 4-7.
- Rossett, A. (2000). What's Academia got to do with it? *TechTrends*, 44(5), 32-35.
- Salisbury, D. F. and Conner, D.R. (1994). How to succeed as a manager of educational change project. *Educational Technology*, July-August, pp. 12-19.
- Scot, W.G. (1961). Organization theory: An Overview and an appraisal. *Academy of Management Journal*, vol. 4, 7-26.
- Seels, B. B. & Richey, R. C. (1994). *Instructional technology: The definition and domains of the field*. Washington, D.C.: Association for Educational Communications and Technology.
- Sparks, D.** (1993, November). Thirteen tips for managing change, Wisconsin School News.
- Surry, D.W. (1996). Defining the roles of the instructional technologist in higher education. In *Proceedings of the 1996 Mid-South Instructional Technology Conference*, Middle Tennessee State University, Murfreesboro, TN. <http://www.mtsu.edu/~itconf/papers96/it.html>.
- Surry, D.W. and Robinson, M.A. (2001). A Taxonomy of instructional technology service positions in Higher Education. *Innovations in Education and Teaching International*, Vol. 38, No. 3, pp. 231-238.
- Tierney, W. G. (2001). Creating a structure for Change. *Academe*, 87(3), May-June.
- Wright, D.L. (1997). Faculty development centers in research universities: A study of resources and programs. In M. Kaplan (Ed.), *To Improve the Academy*, Vol. 18, pp. 291-301. Bolton, MA: Anker Publishing Co. and the Professional and Organizational Development Network in Higher Education.

# Teaching in the 21<sup>st</sup> century: A web experience

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In 1996, Bonk and Cummings set out to design, implement, and refine web-based educational psychology courses and laboratory experiences offered to pre-service teachers at Indiana University. Utilizing the American Psychological Association's 14 Learner Centered Principles (1993, 1997), Alexander and Murphy (1994), Bonk and Reynolds (1997) Bonk and Cummings implemented the universities first on-line course in educational psychology. Course evaluation and subsequent refinement occurred shortly thereafter Bonk & Dennon (1999) and the course framework was considered strong enough for associate instructors to implement.

This paper focuses on the experiences of two associate instructors who taught this web-based course in educational psychology, while simultaneously taking a course in Teaching and Instruction, and consulting with the course designers. While great latitude was given in teaching the course, it was accompanied with the need to justify any revisions. For the most part, each instructor maintained the basic framework during his or her first semester the course was taught. Both associate instructors were graduate students in the Department of Counseling and Educational Psychology with prior teaching experience, although neither had experience teaching an on-line course.

## Technical skills varied

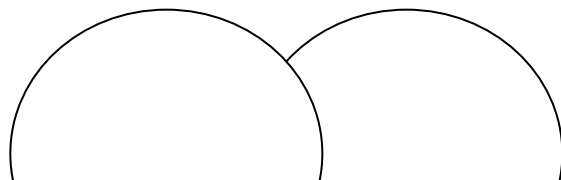
The first step, according to Burger, was to organize an approach to teaching educational psychology on-line. This involved consideration of the material and the method. After reviewing several current texts, Burger chose Snowman and Biehler's Psychology Applied to Teaching - 9th ed. (2000). She chose this text because Dr. Bonk, one of the course designers, wrote portions of the text pertaining to the use of technology, and because the text and course materials, framework, case studies, and other activities were available and integrated, more time could be used to review course material; very helpful when teaching a new course. To maintain the structured feature of the course, Dakwa also selected the Snowman and Biehler text. The integration of technology into the textbook by Bonk (2000) made teaching with the text on-line very appropriate. Especially for first time on-line instructors.

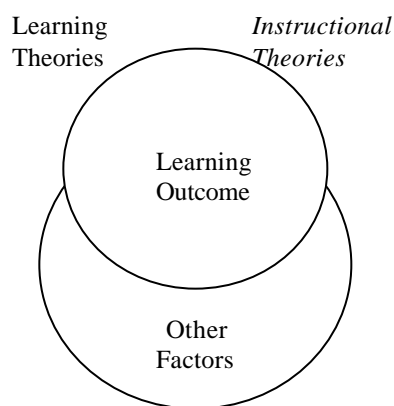
## Instructional Theory

As instructors, we realized that specific instructional approaches adopted could greatly influence student's interest in the classroom and consequently affect student learning of content. - Utilizing a research-based instructional approach, we proceeded to create our on-line classroom.

Instruction, according to Driscoll (1994), is to deliberately arrange learning conditions in such a way that specific goals can be attained. To assist in systematizing these learning conditions some instructional theories have been set out to provide a framework in which these learning conditions can be created. Reigeluth (1983) defines instructional theory as the identification of methods that best provide conditions under which learning goals are most likely to be attained. For the instruction to be successful, it must be compatible with the learning objectives (Reigeluth, 1983; Driscoll, 1994). In our on-line class, our syllabus was very detailed, stressing learning objectives, presenting assignments and all due dates (which were flexible), readings, and description of all course requirements. During the first physical meeting (it is highly recommended that instructors and students meet at the beginning of class if possible) these objectives were discussed in detail, greatly enhancing instructor/student interaction during the course.

Instructional theories encompass learning theories, in that it is the instructional methods adopted by the instructor that will determine the outcome of the learning theory adopted. Figure 1 shows that the core of the instructional process is outcome. Choosing the appropriate instructional theories leads to more effective use of learning theories, and provides a clear path for obtaining instructional objectives. It should also be noted that several other factors contribute to the learning outcome e.g. student motivation, whether class is an elective or requirement.





*Fig. 1. Relationship between Instructional and Learning Theories and other factors influencing outcome*

Particularly for emerging professionals, it is imperative to consider the difference between desired learning outcomes and actual learning outcomes (Reigeluth, 1983). Actual outcomes, Reigeluth writes, are “the real-life results of using specific methods under specific conditions, whereas desired outcomes are goals, which often influence what methods should be selected” (p. 15). This is a crucial point. It is at the beginning of designing the classroom framework that the instructor needs to invest a large amount of time selecting specific methods to be used for the desired learning outcomes.

The Web has created vast opportunities for educators and students, researchers, and practitioners. According to the US Dept of Education 2000 report, 84% of two-and-four year colleges expect to offer distance-learning courses on the web in 2002. Clearly, the earlier work of web educators and student response will be extremely valuable in the coming years. While the basic framework for the on-line course in educational psychology remained stable, the design for the chosen software (SiteScape Forum), as well as the strategies chosen to present the material and specific content for the course, continues to evolve. The growth of teaching on the web continues to expand and it is imperative to be aware of the various pedagogical strategies being developed for on-line teaching; strategies that have been used to harness the current technological advancement and provide efficient, effective, and creative opportunities in education and training.

Duffy and Jonassen (1992) noted that objective perspectives have for some time shaped instructional design practice. They suggested that constructivism provides an alternative basis for conceptualizing instructional experiences. In designing an effective and efficient distributed learning interface, the following seven criteria should be considered: extensive interaction; flexible structure; multiple resources; transparent interface; learner control; attention; and satisfaction. In addition, one might note that the on-line format for this educational psychology course also enhances student information processing ability, strengthens approach to novel tasks, and extends the classroom beyond the four walls by incorporating rich resources from the world wide web and other non-traditional methods.

When teaching in a medium that does not support any physical interaction with students, instructors should structure content so that ideas are related and attention is given to the sequencing of information flow (Reigeluth & Stein, 1983) with special consideration for: selections, sequencing, synthesizing, and summarizing (the four S’s). Structure and clarity is always important in an on-line environment, but particularly so when students are experiencing an on-line course for the first time. Reigeluth & Stein’s (1983) Elaboration Theory of Instruction suggests that instructors first present an epitome, or an instructional block of information, to the students, along with a motivational strategy. This would then be followed by a level-1 lesson, elaborating on various aspects of the epitome. This elaboration serves to help the student organize the content of the epitome. Finally, detailed content, reaching the objectives of the lesson is presented. By systematically presenting the content and summarizing as the lesson is presented, students are able to assimilate and accommodate the content as the lesson proceeds.

The ARCS model of motivational design integrates a wide range of theoretical perspectives including (but not limited to) social learning theory, decision theories, locus of control, and attribution theory. In addition, this theory for instructional design acknowledges environmental and humanistic views, as well as cognitive dissonance and learned helplessness. The acronym ARCS stands for Attention, Relevance, Confidence, and Satisfaction; all-important aspects of motivation. The on-line environment presents particular challenges for instructors when considering issues of motivation. To begin, students tend to perform better in on-line classes if they have developed

a degree of self-motivation and self-regulation. It is much too easy to put off course requirements for an on-line course. Students quickly learn, however, that is also quite difficult to get caught up. During the orientation sessions and especially the first two weeks of a web course, an instructor must remain very sensitive to indications that a student is struggling with issues of self-discipline. Early involvement and interesting activities help significantly. Having a choice in the activities and projects also increases motivation and helps the student become invested in their own learning.

### **The On-Line Experience**

To begin, the first semester, Dr. Bonk (course designer) and Burger (associate instructor) co-presented the student orientation for in-resident students. Dr. Bonk led the general orientation and then each section of the course adjourned to separate computer labs for the individual section orientation sessions. General orientation addressed the field practicum component of the course, while section orientation in the computer labs provided the opportunity for students to become acquainted with each other and course issues such as: course design, requirements, methods for evaluation, the syllabus, and technological issues. A written version of the orientation was posted on-line for distance education students (and for review for the in-resident students, as needed). Students spent a portion of the orientation sessions navigating the web site to ensure they understood the forum layout and how to post responses or modify them.

The following semester, Burger and Dakwa, the associate instructors, co-presented the course orientation in the same general manner. Support from Dr. Bonk was obtained weekly during a continuation of the course in Teaching and Instruction, in addition to individual consultation. This course provided opportunities for associate instructors to explore theoretical as well as practical issues of teaching and learning, and provided the opportunity to raise particular issues or problems in a supportive and collaborative environment.

A constructivist approach to teaching and learning was evident both in the graduate course for the associate instructors, and in the method used to scaffold the instructors into the profession of teaching Simms and Ponder (1997). Further, the approach is evident in the associate instructors' on-line classrooms, embodied in their instructional approach to facilitate learning of the undergraduate students enrolled in the on-line course. So often, a new task can seem overwhelming. However, knowledgeable use of Vygotsky's Zone of Proximal Development (ZPD) with students at any level in their development greatly lessens any sense of bewilderment. Mentoring and apprenticeship were very effective tools enabling an associate instructor to grow gracefully into the profession. We made it a point to have a one-on-one meeting with each student mid-way through the course to obtain student insight and assist with any difficulties the students might be encountering.

The starting point of having a framework from which to teach undergraduate educational psychology was very helpful. The course evolved from a framework that included an interactive textbook, a syllabus, case studies, activities, and an on-line forum to serve as a point of contact between students and the associate instructors. The forum held the course syllabus, course calendar, reading schedule, discussion groups, and places to post the student work, as well as grading criteria and student grades. There were never any questions about what assignments had been received, when they were due, or how many points the student's had earned for their work, as this information was available via the on-line forum.

The opening screen for the SiteScape Forum was rather simple, offering students choices such as: Discussion, Weekly Work, Journal, Projects, or Café. From there, if students selected Discussion, they would then choose Discussion Week 1, Discussion Week 2, etc. The Café held lists of which students were responsible to facilitate each discussion. During the orientation session, students signed up to co-facilitate two weekly discussions. The Café also held "extra's" such as votes taken on classroom issues, current events pertaining to course material, and so on. Designed in this way, navigation was very straight forward, with the majority of students leaving the orientation sessions with complete confidence in their ability to operate in an on-line environment. The course structure encouraged students to contribute frequently and the tasks and activities were clearly specified. Occasionally students asked questions by email, which was usually heaviest at the beginning of the term. Email communication was also used if students had sensitive material to discuss and did not wish to post particular material on-line for the rest of the class to view.

The classroom environment was easily established and a team spirit was recognizable as we worked together to solve functional difficulties that occurred from time-to-time. Not being a technological genius has advantages! The students rallied and we worked together to solve problems such as those occurred when 25 people, of varying experience or skill level, attempt to work together on-line.

Together, as a class, we adjusted when the publisher's website (containing optional weekly activities) experienced technical difficulties and went off-line. We adjusted due dates as needed to recognize the flexibility so

desirable in on-line courses. We examined the impact of due dates and late work both from a teacher's and a student's perspective. Together we explored issues of assessment and evaluation, and all benefited from sharing each other's views enabled by the open, authentic learning environment. Pre-service teachers gained experience by co-facilitating weekly assignments during the on-line class. They created optional weekly activities for the other students. Case studies, in addition to field experiences, provided authentic scenarios for student reflection. Other student's of Dr. Bonk had written many of these case studies previously. Mistakes made were turned into "teachable moments" and every opportunity to discuss educational psychology in terms of the learning we were accomplishing because of our particular course design greatly added to the content of the textbook, journal articles, and field experiences in elementary or secondary classrooms. Duffy & Cunningham, (1996) assert that "learning becomes a matter of change in relation to the culture(s) to which one is connected – with the gradual transformation of one's means of constructing one's world as a function of the change in membership in that culture". Culture in this sense is broad. The culture in which the learner finds him- or herself will determine the kinds of knowledge creation that will occur. We hope that a culture of collaboration and willingness to explore divergent theories in a safe environment will be incorporated and passed on because of experiences such as these.

Open journals pertaining to the student's field experiences illuminated both fears and hopeful expectations regarding first experiences, as novice teachers, in the classroom. Students shared their views in the open journals, and emailed one another. An interesting activity that was used as an icebreaker during orientation, involved students writing one of their fears when entering their classroom for the first time. Responses included "being boring," "not knowing the material," and "the kids won't like me." At the end of the course, when we met to view student presentations, the cards were brought back out and discussed. Most students agreed that they enjoyed hearing about the other students' fears, and were greatly relieved when most of their fears did not actualize. While distance education students did not attend the orientation, or closing meetings, transcripts of the events were posted for their review.

Finally, one insight gained from this experience, is that it is most important to "catch" students before they fail. Sometimes the technological demands are too confusing for beginning students. I lost one student the first semester, as I didn't realize the extent of her difficulties until she was hopelessly behind. To remediate this, I instituted a "mid-term check-up" in which I met individually with each student. We discussed their general progress, problems and insights, plans for their class project, etc, and this became a strategy I will use whether teaching on-line or in a traditional classroom.

Using the American Psychological Association's Learner Centered Principles and a socio-cultural constructivist approach to on-line teaching provides the opportunity for students, at any level, to recognize "the legitimacy and limits of the vast array of approaches" (McCaslin & Hickey, 2001) to teaching and learning educational psychology. Further, a structured framework such as that provided by Bonk and Cummings (1998) provides excellent scaffolding to support an associate instructor's emerging skills when teaching undergraduates in an on-line environment. As the undergraduates integrate knowledge of the content of educational psychology, in the context of an on-line environment, the elementary and secondary students they teach will receive the benefits of an expanded approach to traditional teaching. In this constructivist environment, cognitive flexibility is enhanced.

## References

- Alexander, P. A. and Murphy, P. K. (1994) The research base for APA's learner-centered psychological principles, paper presented at the American Educational Research Association annual meeting, New Orleans, LA.
- American psychological Association (1993) Learner-centered Psychological Principles: Guidelines for school Reform and restructuring, Washington, DC, American Psychological Association and the Mid-continent Regional Educational Laboratory.
- Bonk, C. J. and Cummings, J. A. (1998) A dozen recommendations for placing the student at the center of web-based learning, *Educational Media International*, 35, 2, 82-9.
- Bonk, C. J. and Dennon, V. (1999) Teaching on the Web: With a little help from my pedagogical friends. *Journal of Computing in Higher education* 11,1, 3-28.
- Bonk, C. J. and Reynolds, T.H. (1997) Learner-centered web instruction for higher-order thinking, teamwork, and apprenticeship. In Khan, B.H. (ed.), *Web-Based Instruction*, Englewood Cliffs, NJ, Educational Technology Publications, 167-78.
- Driscoll, M. P. (1994). *Psychology of learning for instruction*. Allyn & Bacon: Needham Heights, MA.
- Duffy, T. M., and Jonassen, D. H. (1992). *Constructivism and the technology of instruction: A Conversation*. Erlbaum: NJ.

- Duffy, T. M. and Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In D. J. Jonassen (Ed.), *Handbook of Research for Educational Communications and Technology* (pp. 170-198). New York: McMillan Library Reference USA.
- McCaslin, M. and Hickey, D. (2001). Educational psychology, social constructivism, and educational practice: A case of emergent identity. *Educational Psychologist*, 6(2), 133-140.
- Reigeluth, C. M. and Stein, F. S. (1983a). The elaboration theory of instruction. In C. M. Reigeluth (Ed.), *Instructional-design theories and models*. Hillsdale, NJ: Erlbaum.
- Reigeluth, C. M. (1983b). Instructional design: What it is and why is it? In C. M. Reigeluth (Ed.), *Instructional-design theories and models*. Hillsdale, NJ: Erlbaum.
- Simms, R. L. and Ponder, G. (1997) Using schooling and technology to learn to teach in the 21<sup>st</sup> century, *Educational Media International*, 34, 2, 94-6.
- Snowman, J. and Biehler, R. (2000). *Psychology Applied to Teaching* (9th ed.) New York: Houghton Mifflin Co.

# With the best of intentions: First semester experiences using BlackBoard

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## Abstract

*In an attempt to provide a central repository of online services, offer services not currently being provided and, through some form of distance education, increase enrollment and therefore revenue, a small northern New York college investigates, recommends policy for, and implements an online course management system. This paper details our procedures, challenges, and experiences with the implementation of BlackBoard 5.0. Recommendations are made to help similar institutions avoid some of the mistakes we made when considering use of such a system. We advocate a systematic reasoned approach to implementation.*

## Introduction

This is a case study. It is a story about the planning decisions and implementation strategies for a course management software package in a small northern New York College. The planning phases and first semester that the course management software was put online is under consideration in this study. One of the researchers was hired in part because his main suit was distance education and is of a unique perspective to look at the college's first semester experiences as it related to the last two or more decades of research in to distance learning. The data collected, outside of being interesting from a narrative perspective, serves as a cautionary tale for institutions of approximately our size (between 4000 and 5000 students). It shows-with the best intentions of everyone involved-how a school unversed in the constructs and constraints of distance delivery both succeeded and failed during its first semester using course management software, in our case BlackBoard 5.0

## Planning and Acquisition

Although the reason for bringing BlackBoard into our school was not clarified to the faculty in specific terms, there was a general sense of the needs of the faculty as demonstrated by their piecemeal efforts at adding electronic components to their courses. Some of these efforts included placing course syllabi on the web, communication among students in a discussion forum, and transferring files between students and faculty. Prior to BlackBoard, each of these services was available and supported separately. Online syllabi were created by the faculty member, and placed in her personal web space. Discussion forums were handled via newsgroups, which could be made available off campus but were this mean that anyone, not just the students in the class, could use them. File transfer was handled primarily via e-mail attachments for off-campus users, while on campus each instructor could create a shared space where files could be made available to students as well as space where students could submit their files to the instructor. One of the pushes for course management software was that there was a general notion that it could do all of these things and more, in an integrated package. Specifics of what "more" constituted was not clearly explicated or fully questioned. Also not fully questioned was how various features were implemented.

The College had a mission of increasing its reach to geographically diverse locations outside of the traditional mix of mostly in-state students. Along with augmenting the instruction given to our current students, there was a sense that this would "open the door" to future inroads in delivering distance education courses. This in turn would mean increased enrollment and ultimately increased revenue. Finally, there was a sense that other institutions were using course management software, and that if we did not adopt something, we would be "left behind."

Among the various competing course management options, the college saw BlackBoard as a solution that addressed both the demonstrated faculty needs and future distance education possibilities. Under consideration were FirstClass, TopClass, and WebCT. FirstClass was seen as not containing enough features such as an online grade book. TopClass had been tried previously in a small test, ending in disastrous results. WebCT was considered to have a higher learning curve than BlackBoard. BlackBoard was marketed as being the most stable, having the best

feature set, and having the easiest learning curve of the competition. Price was also considered, and the most basic level of BlackBoard, level one, was quite inexpensive when compared to the other course management systems. A one-year license allowing us to put every student and faculty member on BlackBoard cost a mere \$5000. As an institution progressed up the levels, the price increased dramatically, but that was not a concern for initial implementation. BlackBoard 5.0 was purchased in the summer of 2000. Unfortunately the BlackBoard approved server, did not arrive until November of 2000, too late for implementation in the Fall 2000 semester.

## **Implementation**

Having been promised BlackBoard for the fall, an incoming faculty member, acting on the advice of representatives of BlackBoard, decided to put a number of courses on the BlackBoard.com site. BlackBoard allows anyone to put courses on their website to demonstrate the capabilities of their system as well as to act as a marketing tool. This became problematic for a number of reasons. Blackboard has enjoyed quick growth, however that growth has created increased Internet traffic, which puts quite a strain on its server, creating a situation of poor connectivity. Attempting to access a course on the website during hours when both the east and west coast were logging on often resulted in not being able to connect at all. If a class was dependent on BlackBoard.com, it was soon found that the class would have to make other arrangements. This was both totally unacceptable and created a bad example for both students and faculty. When connectivity could be achieved, the limited feature set of the site, which we later found out was utilizing BlackBoard level 2, and no technical support increased the problem. At the end of the semester BlackBoard, who had previously agreed to archive these courses for transferal to our local server, would not, the faculty member was told by our instructional support person, respond to repeated phone calls.

BlackBoard 5.0, freshly installed on our Dell server, was rolled out for the Spring 2001 semester. At first the Blackboard server was not meant to provide distance learning in a traditional sense, rather it was put in place to enhance the classroom experience (Dede, 1997). The initial meetings of the BlackBoard advisory committee thought it wise to allow a low number (no more than five) of instructors use the system in the first semester. This recommendation was made since it was clear to the majority of the committee that the first semester was to be considered a beta test, where any kinks or bugs typical with implementing new software would be experienced by a small number of faculty. These faculty members would then in turn be responsible for reporting the problems to be fixed before the following semester, when BlackBoard would be made available to a larger group faculty.

There were two persons put in charge of the BlackBoard initiative. One person was intended to provide instructional support to the professors interested in using BlackBoard; the other would be in charge of maintaining the BlackBoard server. Unfortunately, the instructional support person did not share the same vision as the advisory board. BlackBoard was offered by the instructional support person, to all of the roughly 250 full-time faculty members as something to try if they so desired. This ecumenical concept was contradictory to the advisory committee who had warned that the first semester should be devoted to debugging the system. Forty-nine faculty members decided to use BlackBoard in some capacity for their courses.

BlackBoard was 'sold' to the faculty as a seeming panacea, where courses could easily be put online, and there would be sufficient support for those that decided to take the plunge. As it turned out, people using more than a smattering of BlackBoard spent many hours revamping their courses and a good deal more time than many expected in course maintenance (Palloff & Pratt, 1999). The instructional support, unfortunately, was not sufficient to meet this demand, a situation quite common in such situations (Berge, 1995; Ellsworth, 1995; Green, 1998). The instructional person did not know enough about the BlackBoard environment to adequately support the large number of faculty using the system. This person had no formal training other than being given the manual and being sent to a BlackBoard Conference. In a real sense training was situational and 'on the job'. What was expected to be instructional support became technical support since the support person's time was spent training faculty and dealing with situational problems. On top of that, the server support person was not ready to support demand created by the immediate presence of forty-nine faculty members and over 1000 BlackBoard users. During the first few weeks the server froze if more than a handful of people tried to access the same information at the same time. This became more of a problem since all graduate courses start at 5:30pm and technical support ends their day at 4:00pm, so if the system became unusable, help was not provided until the next day leaving any number of classes floundering. There was no training for students provided by anyone other than faculty who were less than comfortable with using BlackBoard themselves.

As the semester wore on, frustration grew as the instructors who were sold on this 'wave of the future' became frustrated with technical fixes that never came fast enough. To add to this, they also began to rethink why they were using BlackBoard in the first place, as the answer to this salient question was not apparent. Some instructors (Winograd, 2000) became angry over the situation and decided to ditch BlackBoard altogether, some



stuck with it, and had good success with it. The majority of those experiencing success were early adopters of technology, had a basic sense of what to expect through experience with either BlackBoard or another course management system, or started small, using one or two features and building from small victories.

## Recommendations

It is our hope that our experiences may well help other institutions of our size understand the pushes, pulls, and personality aspects of the implementation of a course management system. Careful consideration should be given to 'jumping on the bandwagon.' Looking at this from a critical perspective is invaluable to prevent institutions from becoming cattle following the herd (Winograd, 2000).

It is critical, absolutely vital, that the demonstration projects be of the highest possible standard, since failure or mediocre results will have exactly the opposite effect from what is desired. For this reason it is imperative that financial, technological, and human resources be ruthlessly focused (Moore & Kearsley, 1996).

To this end, we would like to give some basic recommendations to those about to go through what we did:

1. Start with a Needs Assessment.
2. While many of our needs were self-evident, they were not always fleshed out. Many assumptions were made about what faculty wanted and what the course management software could deliver. Some turned out to be accurate, although many turned out to be incomplete or inaccurate. Some of the salient questions we never asked directly included:
  - Do we really need a course management system?
  - What were our goals and objectives?
  - What were some experiences from other institutions faced with the same issues?
3. A needs assessment would not only help us to answer these questions, it also would help us to raise questions that were not necessarily self-evident.
4. Have a timeline for partial and full implementation with significant stages identified. It is critical that the partial implementation phase be used as a test phase for working out the many bugs, both from a technical support and instructional support standpoint. By building from small successes, and learning from problems, the pilot stage can lead to a successful full implementation phase.
5. Have sufficient, qualified technical and instructional support personnel. This is absolutely critical, yet, in reality, perhaps the hardest to assure given the limited human resources of many campuses. It would help if these personnel were acquired via a search, rather than via administrative appointment.
6. Make sure you have strong administrative support, and that the decision making process is a shared decision, not in the hands of a few individuals.

## Conclusion

In conclusion, it could have been better, and it could have been worse. We asked many of the right questions, and had in many regards a well-considered approach. Our failure was that although many useful recommendations were made, very few of them were followed. A reasoned approach is far more helpful than jumping in and seeing what happens. In hindsight, it was a lack of coordination and consistency in the process that led to the majority of our problems. It gives us hope that others may benefit by learning from our experiences.

## References

- Berge, Z. L. (1995). Facilitating computer conferencing: Recommendations from the field. *Educational Technology*, 35(1), 22-30.
- Dede, C. (1997). Distributed learning. *Connection: New England's Journal of Higher Education & Economic Development*, 12(2), 12-16.
- Ellsworth, J. H. (1995). Using computer-mediated communication in teaching university courses. In Z.L. Berge & M. P. Collins (Eds.), *Computer mediated communication and the online classroom: An overview and perspective* (Vol. 1, pp. 29-36). Cresskill, NJ: Hampton Press.

- Green, L. (1998). Online conferencing: Lessons learned (Guide): Office of Learning Technologies, Human Resources Department, Canada.
- Palloff, I. M., & Pratt, K. (1999). Building learning communities in cyberspace: Effective strategies for the online classroom. San Francisco: Jossey-Bass.
- Winograd, D. (2000). The effect of trained moderation in online asynchronous distance learning. Unpublished dissertation, Arizona State University, Tempe, AZ.

# Action Research on Building Learning Communities in Cyberspace

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## Abstract

*The paper reports action research on web-based courses conducted from 1999 to 2001. The goal of the research was to investigate students' opinions toward such courses and to examine the impact of using different strategies on online communities. Data collection relied on online discussion messages, observations, interviews, and surveys. Both quantitative and qualitative methods were utilized in this study. The results revealed that students and the instructor were in favor of web-based courses and that the use of moderating strategies greatly influenced online communities.*

## Introduction

"How many online (web-based) courses does your program offer?" "How often do I have to come to campus for my course work?" Such questions are now being asked much more frequent than ever before, and answers to such questions have become factors for learners to select their institutions and for institutions to attract their students. This fact is changing our society and shifting our educational paradigm. In response to the paradigm shift, many educators offer web-based courses. Some educators have high regards for such courses because they offer opportunities to people who cannot receive education otherwise due to large distance between home and school. Some view it as an alternative that provides learners with options of learning. Some even expect virtual classrooms to be the future of education. Meanwhile, other professionals doubt the value of such education and question its quality. Do students favor such courses? What are benefits and barriers of such a delivery format? How can we make such courses effective? To answer these questions, more research on this topic is needed.

"Online courses," "completely online courses," "web-based courses," "web supplement courses," "hybrid courses," and some other terminology are used by professionals. Some educators consider courses containing online features like synchronous or asynchronous communication to be online courses. According to this definition, courses in which instructors use these features but still meet students on a regular basis would be considered to be online courses. However, other educators disagree and only view courses in which instructors meet students half or less than half of the regular scheduled meeting time during a semester (quarter) to be online courses. Further, even other professionals only recognize courses in which instructors and students do not meet at all to be online courses. To avoid confusion, the author uses the expression "hybrid courses" in this article to refer to the courses in which an instructor and students meet half or less than half of the regular scheduled meeting time, and such courses are the courses involved in this research.

In this article, the author first introduces background that illustrates why the author conducted the research. She then describes her hybrid courses and strategies used in these courses in order to help readers understand the structures of the courses. After that, she reports the action research including data collection, data analysis, and results. Discussions and recommendations are also provided in this article.

## Background

The author is associate professor of Instructional Technology at a state university in the United States of America. The majority of students in her study was in-service teachers and worked full time. They sometimes could not attend classes because of their responsibilities at schools, for examples, open house day, parents day, coach seasons, or because of their obligations to their families. When they came to class, they often were exhausted and hungry because they just rushed to the class straight from their schools, where they had been working for at least eight hours. They sometimes had to call home to check if their children were fine or had to leave classes early because nobody was taking care of his/her family. Observing all the demands that the students encountered, the author realized that these students were different from the students whom she had taught before. The ones she was teaching were reentry students or adult learners while the ones she had taught before were traditional full-time

students. She wondered if a traditional classroom provided her reentry students with good learning conditions and if another educational delivery format would work better for them.

While she was pondering this issue, she received one of her university grant proposal calls, and this grant was designed to support faculty to convert traditional courses to online or hybrid courses. She applied for the grant with the intention to examine if such a delivery format would benefit her students. She received the grant in the spring of 1999, converted a graduate course to a hybrid course during the summer, and implemented it during the fall quarter of 1999. She received positive feedback from her students and continued teaching two additional hybrid graduate courses during 1999-2000. All these three courses were offered at two campuses and offered again during 2000-2001. During these two years, she collected data from her students and conducted research on online instruction. Her hybrid courses and the research are described below.

### Instructional Design and the Hybrid Courses

As Grabowski (2001) stated, instructional design is closely connected to the beliefs of the course designer. Some instructors structure an online course as an independent study, and students receive credits as long as they complete course assignments. Accordingly, students could obtain credits at any time during the semester and have no interaction with other students of the course. On the other hand, some educators design an online course in a way that students have to participate in ample interactive activities with others, such as their classmates. Instructors using the former structure might view independent study, one of the four aspects of distance learning (Keegan, 1993), as an important aspect while educators using the latter one might consider interaction and communication to be essential.

The author of this article supported the latter when she designed her courses. She believed that social interaction plays an important role in learning (Vygotsky, 1978) and valued active learning and meaningful learning (Grabe & Grabe, 2001; Brown, 1992; Knapp & Glenn, 1996; Means et al., 1993). Agreeing with Palloff and Pratt (1999), she regarded an online community as crucial in a hybrid course and designed her courses in a way that her students had to interact with other students to enhance learning. Like Oliva (2000) and Santema & Genang (2000), she encouraged students' active learning and invited students to construct course materials together with her. She met her students four times throughout the quarter—at the beginning, in the middle, and at the end. All assignment submissions and discussions were conducted online via WebCT. She constructed a variety of forums (discussion boards) for students to communicate with each other and to share resources, for example, forums for making announcements, for asking questions and receiving help concerning technical issues, for submitting assignments, and for providing feedback and critiques to their classmates. In all her courses, students had to post their assignments to the forums, review assignments of their classmates, and critique each other's assignments. These activities provided students with basic channels for communication.

	1999-2000 (without moderating)	2000-2001 (with moderating)
F	Synchronous (Instructor posting topics)	Asynchronous (Medium-duty moderating)
W	Asynchronous (Student posting topics)	Asynchronous (Heavy-duty moderating)
S	Asynchronous	Asynchronous (Light-duty moderating)

Table 1. Different strategies used in the hybrid courses. F = Fall quarter, W = Winter quarter, S = Spring quarter

In addition to using assignments to enhance interaction, the instructor also employed different strategies to facilitate students' communication. Table 1 above shows strategies used in her hybrid courses. She used moderating strategies during the second year (2000-2001) while she did not use them during the first year (1999-2000). During the fall quarter of 1999, all students conducted synchronous communication every week and discussed topics that were posted by the instructor. During the winter quarter of 1999, students used forums to conduct threaded discussion about topics generated by their classmates. During both quarters, students obtained participation points based on frequency and quality of their posted messages. They were aware that they had to post at least two messages every week to receive participation credits. Such participation requirements were not expected during the spring quarter of 1999.

During the second year, the instructor used moderating strategies in the three hybrid courses in which students took turns to moderate their online community for a week. It was understood that the instructor would not jump in to answer questions unless it was necessary and that the students would receive credits based on how well they moderated the community. For example, if a question or a problem on a discussion board remained unanswered or not acted upon, the moderators of the week would be marked down. Moderators did not have to answer all questions or solve problems but they needed to facilitate discussions about the issues within the community.

Based on responsibilities and tasks the students conducted, the moderating strategies varied. The instructor categorized them into three types of moderating: medium-duty, heavy-duty, and light-duty. During the fall quarter while the medium-duty moderating was conducted, moderators posted discussion topics, hosted online discussions, and answered questions posted by their classmates. During the winter quarter while the heavy-duty moderating was conducted, moderators not only took on the same responsibilities as in the previous quarter but also assigned readings, generated rubrics, and further evaluated their classmates' online performance. During the spring quarter while the light-duty moderating was conducted, moderators only needed to host online discussion and answer questions posted by their classmates.

## **The Research Study**

The goals of the research were to investigate students' opinions toward hybrid courses and to examine the impact of using different strategies on online communities.

## **Subjects**

The participants of the study were the students in the twelve hybrid courses during 1999-2001. They were in-service teachers who were pursuing their Master's degree in Instructional Technology at the university and had little experience with hybrid courses.

## **Methodology**

At the beginning of each course, the instructor explained to the students the course and their responsibilities, especially their duties related to the different strategies used in an online community. During the courses, the instructor posted questions for discussion. Examples of questions included (1) What are benefits and barriers of hybrid courses? (2) What are advantages and disadvantages of conducting synchronous and asynchronous communication in hybrid courses? (3) Do you like the moderating strategies used in this course? and so forth. During the last meeting of each course, students filled in a survey that contained 10 Likert scale (1-4) questions and open-ended questions. The Likert scale questions were guided to examine the following points: (1) Compared to a traditional class, did students feel that they learned as much as, or even more, in the hybrid course? (2) Compared to a traditional class, did students feel that they spent as much as, or even more, time preparing for the class? (3) Compared to a traditional class, did students feel that they were motivated as much as, or even more, to learn in this course? (4) While taking the course, did students have sufficient access to the instructor? (5) While taking the course, did students have sufficient interaction with other students in this course? (6) Given the choice between traditional courses and hybrid courses, did students prefer a hybrid course if the course content were suitable for a hybrid course? (7) Did students wish that more hybrid courses were offered in the Masters program at the university? (8) Would students enjoy taking another hybrid course? (9) Were students concerned about the quality of hybrid courses? (10) Did students like the delivery format? (11) How many sessions in which the teacher and the students meet would be appropriate for a hybrid course? Open-ended questions of the first year focused on benefits and barriers of hybrid courses while those of the second year emphasized the impact of moderating on online communities.

In addition to online messages and surveys, data was also collected from observations and interviews. The author observed students and activities online as well as during class meetings. Interviews were informal and occurred when there was a need for clarifying students' comments.

The author tabulated the survey data. She also downloaded students' messages related to the research, color-coded messages, and categorized them into appropriate folders based on the topics, for example, benefits of web-based courses and barrier of web-based courses.

## Results and Discussions

The table below reports students' opinions toward the hybrid courses offered from 1999 to 2000. As mentioned above, the first course was funded by an internal grant and was used as a pilot to examine if the students preferred a hybrid course to a traditional one. The survey used in the first course was modified and improved for the upcoming quarters, which explains why some numbers in the table are missing.

First Year	Pilot (F)	2 <sup>nd</sup> (W)	3 <sup>rd</sup> (S)
Learn more	2.13	3.08	3.46
Spent more time	1.75	3.51	3.58
More motivated		3.30	3.52
Access to instructor	2.25	3.58	3.39
Interaction with students		3.06	3.22
Prefer a WB course	3.38	3.40	3.68
Wish for more WB courses in program	2.88	3.40	3.55
Enjoy taking another WB course	2.75	3.58	3.55
Concerned about quality of WB course		2.05	1.64
Like the delivery method	3.31	3.20	3.52

.F = Fall quarter, W = Winter quarter, S = Spring quarter

Table 2: Students' responses during 1999-2000. WB = Web-Based (hybrid) course

The results indicated that students were in favor of a hybrid course. The students felt that they learned as much as or even more in such course and that they were more motivated. They wished that more hybrid courses would be offered in the academic program, and they preferred a hybrid course to a traditional course.

Most of the means on table 2 went up when time progressed. The instructor felt that this fact was partially due to the experiences she and her students gained from the hybrid courses. She also felt that certain characteristics were necessary for people to succeed in such courses, for example, being self-disciplined. Since the students and the instructor did not meet every week, students had to be self-disciplined and be able to complete tasks without much supervision. More than half of the students revealed in their surveys and interviews that online learners should be self-disciplined and complete tasks on time. Four students who received incomplete during the first quarter pointed out a need of such characteristic. One of them said, "I have difficulty in the online [hybrid] course because I'm not so disciplined and often postpone my work. In a traditional course, I would be reminded every week when I go to class. But this is not the case for taking an online [hybrid] course."

Although people who tend to delay their work might have difficulty surviving in hybrid or online courses, the instructor believed that preparing students' mindset before they took such courses could be helpful. Therefore during the first meeting of her courses, she always asked students who had taken her hybrid course(s) before to share with other students tips of being online learners. "Don't postpone your work" was mentioned repeatedly by the students.

As mentioned earlier, students conducted synchronous communication in the first course and asynchronous communication in the second course. In both courses, students received participation credits. In the third class, asynchronous communication was utilized but no participation credit was issued. The different strategies used in these three classes had an impact on the online communities. The research results indicated that synchronous communication strengthened students' sense of belonging. A student stated, "Although we do not see each other every week, the real-time communication makes me feel we belong to the same class." Such a sense of belonging was less common when asynchronous communication was used during the second quarter. During that quarter, a few students addressed that they missed real-time communication and requested the instructor to sometimes conduct such communication while they were enjoying the flexibility that asynchronous communication provided. Observing the three courses, the instructor found that the online community of the third course seemed to be loose and thought that issuing no participation credits might have contributed to the loose community. The instructor suggests online instructors employ asynchronous communication and synchronous communication alternatively and use participation credits to motivate students participating in online communities.

Students listed several benefits of a hybrid course: flexible schedule, being able to work at any time and at any place, and being able to choose the best conditions for learning. They also mentioned that hybrid courses saved them gas and time on commuting and allowed them more access to instructor and to their fellow classmates.

Barriers also existed in a hybrid course. The participants missed face-to-face communication and personal contact. Students with low technology skills felt pressured and anxious. Such pressure and anxiety might create a negative impact on learning. Despite these barriers, students expressed that they would still choose a hybrid course over a traditional one if they had an option.

Like the students, the instructor enjoyed the flexibility hybrid courses provided and missed face-to-face contact with her students. Unlike the students, she experienced tremendous pressure of responding to students' messages and of their expectations of receiving responses instantly. Meeting students once a week in a traditional course became meeting students 24 hours a day, seven days a week online. In addition, it was time consuming and stressful to communicate with a couple of students who often got confused and repeatedly asked the same questions no matter how clear information was, for example, on when an assignment was due and when the next meeting would be. Such stress was eased during the second year when moderating was used in her courses.

During 2000-2001, the instructor utilized medium-duty moderating in the first (Fall) quarter, heavy-duty moderating in the second (Winter), and light-duty moderating in the third (Spring) quarter. As mentioned earlier, the differences among the three types of moderating were based on responsibilities and tasks students conducted in the hybrid courses. Data collected from survey open-ended questions, online discussions, observations, and interviews indicated that both the students and the instructor favored the use of moderating in the courses. The students felt sense of ownership of their online communities and learned from their peers by observing how their peers hosted the communities. They received answers much faster than before because every member of the communities tried to help answer questions. The instructor also favored the moderating. She noticed that she was less stressed responding to students compared to the first year and that the students received responses faster and became very active in the online communities. The communities became very dynamic, and she felt the courses sometimes could smoothly move forward like a car with a "cruise control".

Second Year	1 <sup>st</sup> (F)	2 <sup>nd</sup> (W)	3 <sup>rd</sup> (S)
Learn more	3.73	3.15	3.46
Spent more time	3.90	3.93	3.73
More motivated	3.80	3.33	3.56
Access to instructor	3.83	3.62	3.43
Interaction with students	3.50	3.45	3.46
Prefer a WB course	3.81	3.42	3.73
Wish for more WB courses in program	3.85	3.63	3.63
Enjoy taking another WB course	3.72	3.66	3.70
WB providing better quality	3.70	3.45	3.70
Like the delivery method	3.70	3.27	3.66

F = Fall quarter, W = Winter quarter, S = Spring quarter

Table 3: Students' responses during 2000-2001. WB = Web-Based (hybrid) course.

Among the three different moderating strategies, the students favored the medium-duty moderating the most and the heavy-duty moderating the least. During the winter (heavy-duty) quarter, the responsibilities of the students and their activities appeared too complicated. Moderators of every week tried to do a good job by assigning readings, setting objectives for the week, and facilitating discussion; often their readings and objectives were too many to be accomplished within a week. Students conducted many different activities when time moved on. At the end, they were distracted by the objectives of different moderators and forgot the objectives of the course. In addition, moderators often had to participate in activities of a week while they were still evaluating their peers' online performance of the week when they were the moderators. This was indeed a hectic quarter, and the instructor learned a big lesson from the experience. Appropriate amount of online communication could enhance learning while too much communication might cause learners to withdraw from the community (Palloff and Pratt, 1999). Students' dislike of such moderating is clearly revealed in the table above. A number of the means during the winter quarter dropped and consistently appeared to be the lowest among the three courses. Students spent a lot of time (mean=3.93) on the course but did not necessarily learn more (mean=3.15). They liked the course the least (mean=3.27) compared to the other two courses of the year.

Although the Winter quarter was hectic, students still favored hybrid courses. Issues addressed during the first year, like benefits of such courses and their wish to have more hybrid courses in the program, repeatedly appeared in the second year. Students also liked the fact that they had to post their assignments and review their

peers' work. By doing so, they learned much from their peers. They liked meeting three to four times per quarter and did not seem to favor an online course without a face-to-face meeting.

A hybrid course did provide flexibility and convenience to learners, especially to learners at remote areas. While hybrid courses are blooming in many places, the author thinks that hybrid courses should not (1) be independent studies in which no interaction among students are necessary, (2) be only task-oriented in which social learning is neglected, and (3) lower the quality of education. Instead, the courses should be structured to raise the quality of education because learners have (1) options to choose their best learning conditions and (2) opportunities to enhance their learning using resources beyond boundaries of time and space.

## **Conclusion**

The paper reports action research on online courses conducted from 1999 to 2001. Data were collected from three courses (12 course sections) at two campuses during the two years. Data collection relied on online discussions, observations, interviews and surveys. Both qualitative and quantitative research methods were used in this study.

The results indicated that students and the instructor were in favor of hybrid courses and that the use of different strategies had an impact on online communities. Using synchronous communication and asynchronous communication alternatively could enrich online communities, and moderating strategies with careful design and organization worked well in hybrid courses.

Instructors should employ a variety of strategies to build up and nurture an online community that may lead to a success of hybrid courses. This new delivery method provides students with options of choosing their best learning conditions and with opportunities to enhance their learning using resources beyond boundaries of time and space. One can see its potential and positive impact on our education and society.

## **References**

- Brown, A. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences*, 2(2), 141-178.
- Grabe, M. & Grabe, C. (2001). *Integrating technology for meaningful learning*. Boston, MA: Houghton Mifflin Company.
- Grabowski, B. (2001). "E-Learning: Instructional Design Considerations". Presented at the annual convention of World Conference of Educational Multimedia, Hypermedia, and Telecommunications, Tampere, Finland, June.
- Keegan, D. (1993). *Theoretical principles of distance education*. London: Routledge.
- Knapp, L., & Glenn, A. (1996). *Restructuring schools with technology*. Boston: Allen & Bacon.
- Means, B., Blando, J., Olson, K., Middleton, T., Morocco, C., Remz, A., & Zorfias, J. (1993). *Using technology to support education reform*. Washington, D. C.: Office of Educational Research and Improvement.
- Oliver, R. 2000. "Web Tools: Flexible and Reusable Resources for Web-Based Learning". Presented at the annual convention of World Conference of Educational Multimedia, Hypermedia, and Telecommunications, Montreal, Canada, June.
- Palloff, R. M. & Pratt, K. (1999). *Building Learning Communities in Cyberspace*. San Francisco, CA: Jossey-Bass Inc.
- Santema, S., & Genang, R. 2000. "Rethink Education: How We Make Our Learners Instructors". Presented at the annual convention of World Conference of Educational Multimedia, Hypermedia, and Telecommunications, Montreal, Canada, June.
- Vygotsky, L. (1978). *Mind in society: The development of higher mental processes*. Cambridge, MA: Harvard University Press.



# **Building online Executive Education courses that work: Design opportunities and challenges**

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## **Abstract**

How can instructional designers create executive education, seminar style (non-credit) courses that are short (one-two hours) but still provide a meaningful learning experience for managers and executives in an organization? Engaging and motivating learners in short courses without traditional assessment formats or external motivators such as grades or academic credit is hard to do and presents a challenge for designers who have “grown up” developing academic courses or professional training for traditional programs. This paper presents several design solutions that have been successful in this context. Unique instructional features, specific instructional design challenges, and a program of ongoing research are also described.

## **Introduction**

Executive education courses are used to teach managers and executives the skills they need to succeed in corporate leadership. The audience for these courses is typically the managers across a company or business unit within a corporation. Common topics include leadership and management styles, strategies, and tactics, motivating employees, project management, business strategy, and many others. Executive education courses differ from traditional business academic courses in that they are generally shorter, and do not offer academic credit for successful completion. We have created many executive education courses in our role as instructional designers for UNext, Inc. and Option Six, Inc. This paper describes two of the most successful course models we have developed and implemented. We will explain the pedagogical approaches we have used, describe relevant course features, discuss the instructional design challenges we have encountered, and briefly explain our ongoing research agenda.

## **Executive Education**

In the past, it was all too common for a company to promote an employee to a management position without providing any training or education targeted at the new roles and responsibilities of this new position. The new manager was expected to transfer their proven “line” expertise into the realm of management without retraining. Unfortunately this approach does not work well for many new managers. They are suddenly expected to understand cross-functional business concepts such as those in managerial and financial accounting, marketing, sales, and managing people. Training and expertise in one area of a business as a line worker (e.g. as a sales associate, marketing analyst, or manufacturing supervisor) does not necessarily provide the ability to excel or even function in the cross-functional world of management.

It is important for managers to be able to understand the basic concepts and language used in the other areas of their company. Why is it important to work within the information technology constraints dictated by the network manager? Why is it important to use the “company colors” on all new products? How do the operations of a certain business unit affect the corporate financial statements? Why is this important to the health of the company? These are questions that executive education courses are designed to help new managers and executives answer for themselves. They don’t need a thorough conceptual understanding of accounting systems or network security measures, such as they might receive in a certification or academic MBA course, and a one to two hour course or suite of courses is often sufficient.

Executive education courses have often been delivered in traditional training environments, such as corporate training classrooms or off-site seminar rooms. The online courses we create are experienced in an

anytime, anywhere format from the manager's networked computer, at work or home, whenever they have the time in their busy schedule. We have found most participants are able to devote an hour or two at a time to this kind of training. We attempt to keep each suite of courses short enough so that a new manager could finish the entire suite in one business day. In many situations, one dedicated "learning" day is more effective than trying to stretch the course out and keep participants motivated over several weeks. Occasionally, a business will have experience and resources to implement a synchronous online seminar setting, a "virtual classroom." If this is the case, we design courses that exploit this capability. It should be noted, however, that the instructional experience (information, learning, knowledge, etc.) in each course is designed to be completely accessible even if the synchronous component fails or is inaccessible to some participants. In fact, this is one of the design challenges we discuss later in this paper.

### **Instructional Approaches**

We have developed and implemented two major models of instruction for executive education courses. While we have used other instructional approaches for specific training needs, we believe our two primary approaches fit most of the learning content and situations that we encounter. In each course model, we have implemented the learning values of experiential learning (learning by doing) (Dewey, 1897; others?). We believe that active learners are much more likely to learn than passive ones, so each course uses many interactive elements (cite interactivity in learning research).

### **Cognitive apprenticeship**

The first model we used for executive education is based on the cognitive apprenticeship theory of learning. In this theory, founded primarily upon Vygotsky's notions of sociocultural learning and the zone of proximal development (ZPD), learning is accomplished by participants as they are guided through the study and experience of new information and skills by cognitive experts (Rogoff, 1990; Vygotsky, 1978). The expert begins with a large amount of control over the learning process and content, and gradually turns over more and more control of the learning to the learner. By the end of the experience, the learner is ready to perform the new skills or apply the new information on their own, in their own environment, as they begin to develop their own expertise through authentic practice.

In the training environments we create, the online course is the expert that guides the student through the learning experience. We structure the overall course experience and embed various course elements that support and guide the students' learning throughout. Beginning with a motivating and engaging lead-in to the content, we use predictable course segments that move from high "scaffolding" and gradually reduce the amount of scaffolding as the course progresses (Bruner, 1983; Rogoff, 1990; Stone, 1993; Vygotsky, 1978). In the end, the student is given tools and references to use on their own in their own work environment. Next, we'll briefly explain the course structure we've created. Please refer to figure 1 to see an example of this course structure from an actual course.

Each course is bundled with related courses in a course suite. Usually, there are four to five courses in one suite. Suites can be completed within one business day, in approximately eight to ten hours. In figure 1, the courses in the "Learn to Speak Accounting" suite are shown on the left side of the navigation frame (on the left). While there is no technical barrier to taking any course in any order, there is an implied order in the navigation system. In practice, it usually makes good "sense" to take the courses in their listed order, but we allow the learner the freedom to choose. Each course is further divided into common sections. Once again, the technical system does not require the student to follow the implied (physical) order as they work through the course, but the course content and connecting language used strongly suggest the implied order. These sections are listed in order on the right side of the navigation frame in figure 1.

### **Why Learn It**

The first section of each course, the Why Learn It section, is designed to motivate the student's further study of the course content. Using a combination of text, images, vide, and multimedia, the overall importance of the content is explained. Often, we use a short case experience to engage the student, asking them to read or view a situation and make a few basic decisions. This experience is intended to show them that they may do not have all the answers or expertise (e.g. how to motivate different employees) they need, and that this course can help them develop their own expertise.

### **How It's Done**

The second section of each course is the “How It’s Done” section. The purpose of this section is primarily expository – explaining how a concept works in practice, how processes are carried out, or perhaps presenting a body of information that will be used in some subsequent practice or activity. The How It’s Done section uses video segments, animations, text, and graphics to present information. A constant instructional practice is to include many relevant examples and cases of real companies and situations to maintain high student interest and increase the practicality of the instruction. Throughout this section, the course designer is still in control of the learning process for the most part. While no particular order is technically mandated, students generally read the text from start to finish, interacting with the course to watch videos and animations and read extra material in pop-up windows as they progress.

### **You Do It**

The next section, “You Do It,” provides an opportunity for the student to apply the information they have read, watched, and begun to learn in the How It’s Done section. The You Do It section is focused on guided student activity. The course sets up a “practice field” (cite Duffy) in which the student applies information in a constructed learning space. Activities take the form of website visits, interactive animations, text-based problem scenarios, and others. The student is given more control over their own learning now, with opportunities to repeat activities, sometimes with different conditions. Some courses present several different activities that the student can choose from. We have seen students use “optional” activities in many different ways. Some students try every activity once and move on. Other students try each activity over and over until they master each. Still other students only work through one activity and then continue.

### **Explain It**

The “Explain It” section presents the student with a chance to explain what they have learned by answering several free response questions. Students submit their answers and receive direct feedback after just a short wait (20-30 minutes). Questions usually require the student to use simple analysis, synthesis, or application skills to create fully correct answers. These questions provide an opportunity for the student to check their understanding and demonstrate that they are learning course content, and not just clicking through the course without much thought.

### **Now Think Again**

The last section of each course, “Now Think Again,” challenges the student to think about the course content in a new way – often in the context of his or her own work environment or from an alternative perspective (as an employee versus as a manager, for example). The course provides printable documents the student can “takeaway” from the course to help them implement new knowledge and skills in their work. Suggestions for further reading and helpful website references complete the course content, providing resources for the student to use after the course experience is finished. Many students report that this is one of the most useful sections of the course, especially links to relevant websites. In this section, the student is in almost full control of his or her own learning. The course content takes the form of a library of resources for the student to use as he or she applies new knowledge on their own in their own unique situation.

Figure 1. Cognitive apprenticeship course model: Learn to Speak Accounting.

mean, you could simply open your money bags and start counting. But since this is not the case, you may find the following exercise in determining your level of economic wealth interesting.

[Transcript](#)

The previous exercise focused primarily on individual wealth and the elements of resources and obligations that can be used to compute the wealth of an individual. At the end of that exercise, you were exposed to the resources and obligations of a company. You are probably familiar with the concept of a company. Fiat, Club Med, and Microsoft are all examples of companies. Their business operations differ greatly; so what characteristic makes them companies to begin with? Accounting views companies as wealth-creating entities.

[Transcript](#)

From the perspective of financial accounting, companies create wealth by engaging in financing activities (a transfer of wealth into the business), investing activities (converting capital to plant and equipment), and operating activities (producing products and services that can be sold to create

Mike Kirschenheiter explains how accounting policies vary depending on time and place. Play [video with transcript](#) View [transcript only](#)

[The value of an asset is time and place dependent.](#)

[Two branches of accounting that companies use.](#)

in-box talk print glossary help

### Additional Course Features

This course model takes advantage of other features that contribute directly to its effectiveness. We use short video segments of experts, usually notable business professors, that highlight key points in the content or answer frequently asked questions. Links to video segments are located in the right margin of the course content page (see figure 1.). Transcripts of each video segment are included -- just in case there are technical limitations that preclude a student from viewing one of the videos. We use Flash animations to motivate student interest, explain complex concepts, and provide interactive exercises (see figure 2.). We provide transcripts for animations that explain concepts, since they often include core course content, and students occasionally experience technical difficulties when viewing animations. Finally, we use many “pop-up” windows to display additional information to the student. These pop-ups are indicated by standard hyperlink formatting, underlined blue text (see figure 1.). The types of information we present in pop-ups include; answers to course questions, additional reading material (articles, case studies, etc.) and glossary definitions. Pop-ups increase the level of learner-content interactivity, improving the overall student experience (Gilbert & Moore, 1998; Hannifin, Hill, & Land, 1997; Trentin, 2000).

Figure 2. Interactive Animation



### Sample Course: Learn to Speak Accounting

One of the courses created using this instructional model is titled “Learn to Speak Accounting.” This course is designed to help non-accounting managers understand basic accounting principles so they can communicate with corporate accounting staff and manage their own business functions with more fiscal soundness. The target audience for this course is non-accounting managers: engineers, manufacturing, marketing, etc. managers who do not have an accounting background yet have (new) fiscal responsibilities that include making decisions that affect or that are affected by accounting systems. Sometimes, a new manager who does not have a financial background may tend to make business decisions for their unit or group without taking into account various accounting factors that could help them understand the flow of wealth within their company. A core assumption (and assertion) of the course is that understanding these factors can help managers make better business decisions.

### A New Approach to Teaching Accounting

This course presents the concepts of accounting in a new way. Instead of beginning the study of accounting from the bottom up, by discussing debits, credits, and accounts, this course takes a “top down” approach, beginning with the grand issues of accounting, such as how to read annual reports. Specifically, the course begins by showing how accounting tracks the resources, obligations, and wealth of a company. These are presented in the company’s annual report, an important document for business professionals. As the student examines the different parts of the annual report, the key concepts of accounting, such as different accounts and how transactions affect those accounts, are revealed. This top down approach is effective as it gets the student involved in a (more) familiar practice such as reading annual reports and then presents the more specific (and unfamiliar) concepts of accounting that relate to the report.

### Key Course Features

Throughout the suite of LTSA courses, there are many opportunities for the student to practice applying the information and concepts introduced in the course. Many of these practice opportunities take the form of interactive

(Flash) animations or visiting live websites and analyzing real accounting information from existing companies. Additionally, each How It's Done section in this suite utilizes an interactive (Flash) animation that requires the student to apply the course concepts in a realistic business situation. See figure 2. for an example of one of these interactive tools. This practice is focused on developing basic skills and understanding of the concepts just presented. Finally, in each You Do It section in this suite we challenge the student by asking him or her to apply the new information he or she has just read and explored through a visit to a real company's website. A sample of the tasks he or she may be asked to complete includes looking for general corporate financial performance in a company's annual report, exploring the detailed financial statements found in real annual reports, and comparing methods of accounting as evidenced in a company's annual report with common or accepted methods discussed in the course.

### **Problem Centered Learning**

A second course model we have used uses a problem centered approach to design and instruction. Starting off by considering the problem the student is facing, or in some instances the "guiding question" the student is trying to answer, is helpful both for the student as they enter the course, but also for the design team as they create the instruction. Since most learning takes place as the result of a gap between what a learner knows and what a learner wants to know, starting with what exactly the learner wants to know (problem to be solved, major question to be answered) makes sense (Savery & Duffy, 1996; Merrill, 2000). After starting with the problem, the instruction must present the student with the resources and guidance needed to solve the problem or answer the guiding question. Providing multiple opportunities for practice and supporting the student as they leave the course and apply their new knowledge in their normal jobs is the final phase of this instruction. In essence, this course design includes four phases; problem (Why? What context?), information (What? How?), practice (I try with you), and transfer (I go it alone). This overall approach to instruction includes some elements of cognitive apprenticeship as well, since the student receives fading support or scaffolding as they progress through the course.

### **Sample Course: Post-purchase Marketing**

This one to two hour course was designed to teach the concept of marketing after the sale – post-purchase marketing, to various levels of employees in a business. Everyone who comes into contact with customers, or whose work directly impacts a customer's experience after they have purchased a product (or service) from the company, should understand these concepts. On a large scale, this course is designed to help an entire organization understand the importance of after the sale marketing efforts. See figure 3 for the problem-setting page of the course.

The course sections are accessed using the navigation panel on the left. In this course, there is an Introduction section, a problem setting section, four sections devoted to new content information, a problem solution (practice) section, and a final section devoted to supporting the student's transfer of their new knowledge from their course experience to their own workplace.

Figure 3. Problem-centered Learning Course: Post-purchase Marketing

The screenshot shows a course page for 'trouble at dyi software'. On the left, a navigation menu lists course sections: Introduction, Trouble at DYI Software (highlighted with a red arrow), The Fifth "P" of Marketing, Improving Customer Satisfaction, Fostering Customer Loyalty, Marketing to the Individual, Creating a Plan For DYI, and Creating Your Own Plan. Below the menu is a portrait of a man with a grey beard. The main content area features the title 'trouble at dyi software' in red, followed by a paragraph: 'In this course, you will take the role of an employee at DYI Software Solutions, a maker of home office software. After gathering information about DYI's marketing problem and learning more about postpurchase tactics, you will have a chance to create a solution for DYI.' To the right is the DYI Software Solutions logo. Below the text is a 3D rendering of a software box labeled 'DYI OFFICE CHORES 3.0'. A paragraph follows: 'Here's the situation: The company's marquee product, DYI OfficeChores, sold extremely well initially, but sales of its first upgrade, released one year ago, have been poor. As DYI gears up to release OfficeChores 3.0 in the coming months, the company wants to improve its sales outlook. You have been called to a meeting with various department heads to discuss what is wrong with the marketing strategy. Watch the video to attend the meeting.' Below this is a 'Video' section with links for 'View video', 'Transcript', and 'Preliminary Survey Findings'. A paragraph describes the assignment: 'After attending the meeting, your assignment is clear: Help develop a marketing strategy that addresses three major areas of postpurchase marketing that were identified by the market research company: customer service, loyalty, and customization. Funding is always a concern, so prioritize the parts of your strategy with cost in mind.' The final paragraph states: 'The next sections of the course will help you explore postpurchase tactics you will need to understand and incorporate in your'.

## A New Approach to Teaching Marketing

The Post-purchase Marketing course takes a different approach to teaching marketing. Instead of starting the course with the concepts of post-purchase marketing, the student is presented with a business problem that needs resolution. A fictional company, DYI Software, is experiencing reduced sales and low customer satisfaction. The problem appears to be a failure in post-purchase marketing efforts. The student is given the task of learning about post-purchase marketing and then coming up with a new marketing strategy for the company. As the student moves through the rest of the course, they are presented with the key concepts of post-purchase marketing to help them in formulating their own strategy. Examples and interactive practice elements give the student the opportunity to apply principles learned before embarking on the strategy project for DYI. Throughout the course, the student has the opportunity to interact with other students, posting questions and ideas in the course discussion forum.

## Key Course Features

This course uses many of the same instructional methods, tools, and techniques as the cognitive apprenticeship courses do. One additional feature we added to this course we call “embedded self assessments” (Beatty, Branon, & Wilson 2001). This feature was added to assist the student’s self-regulatory behavior (Schunk & Zimmerman, 1998) during their learning experience (see figure 4). Embedded self-assessments (ESA) are short opportunities for students to assess their understanding while they are learning new course content. They are “embedded” in that they are included within blocks of content, not grouped at the end of a content section as is traditionally done in instructional texts. We believe that ESAs help students understand whether they are truly learning the course material *before* they get to the comprehensive assessment at the end of the course, *before* they attempt to apply course content in a practice situation. Additionally, students have reported that ESAs help them stay focused on the learning task at hand.

Figure 4 shows an example of the type of ESA used in the post-purchase marketing course. In general, we ask the student to answer a free-response question, and then provide an opportunity for them to check their answer with an “expert” response. Another type of ESA we have used is multiple choice with immediate feedback. We have found that different students have different ESA style preferences (Beatty et al., 2001), and different course content fits different ESA styles as well.

Figure 4. Embedded Self-assessment

### Self-assessment

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Answer the question below in the space provided. When finished, click "Submit." Then compare your answer to the expert answer provided.

Since DYI is a technology company, what are some ways it can employ technology to help improve customer service and satisfaction? List at least three ways technology could be used, and briefly explain how each way might help improve customer satisfaction.

Your answer:

One way technology could be used is for it to be the center of the customer's experience. Another way it could be used is to form the communication backbone between DYI and its consumers. Finally, technology could facilitate the exchange of new product ideas

**Submit** >>>

**Compare your answer.**

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Technology could be employed in a variety of ways to improve customer service and satisfaction. Customer service employees can definitely use technology to access detailed product and service information specific to the customer. This can help customers feel like the company understands them as individuals and can help solve problems more quickly with

## ID Challenges

### One course model fits all ...

One of the challenges to building executive education is that training departments often want a “one-size-fits-all” approach to courses. Having a single course model is easier to manage and track but the reduction in flexibility can detract from learning and motivation. For instructional designers, this can mean having to work with a less than ideal pedagogical structure for some topic areas. In the future, Learner Management Systems (LMSs) should become more complex in how they track learners, thus making it possible that this problem can be reduced.

### Working with Subject Matter Experts (SMEs)

Finding SMEs can be a major hurdle for high-level online executive education. Ideally, a SME should be someone who is an executive and has experience in the narrow topic being covered. The obvious issue is that people with such credentials are extremely busy running companies or consulting and the incentive to have them develop an online course has to be high. Even when a person has been located with the correct skills and knowledge, they probably do not understand the instructional design process.

Working with SMEs has always been a challenge for instructional designers. When developing short, specialized e-learning, however, the difficulty can become acute. Because SMEs are experts, it is often difficult for



them to write high-level pieces that need to be delivered in a short period of time. Additionally, the expert status of a SME means that they are not used to working in a team-based development environment. The process of negotiating can require astute political skills on the part of the instructional designer, especially when determining what content is 'critical' for an executive level course.

### **Can accounting really be made motivating?**

Unless a person works as an accountant, a course in accounting is probably not one that would be taken by choice. Accounting skills, however, are important for managers at nearly every level. They might not need to be able to handle accounting functions directly, but having a working knowledge of accounting fundamentals can improve their ability to run their department. By understanding this perspective, an instructional designer can build a course that is interesting and motivational for a variety of executive learners.

### **Learner persistence**

Even if a course is short and filled with motivating animations, videos, and content, business managers are always very busy. The temptation can be to move through the training module as quickly as possible. Simply paging through screens does not mean that learning will occur yet, emphasizing this to someone with limited time can be difficult in an online environment. Keeping people on task and focused will in an online environment will likely continue to be a vexing problem for designers.

### **Ongoing Research**

We are engaging in ongoing research projects at Option Six to help us understand online learning better and focus on creating more effective learning environments for each of the instructional situations that we encounter. The corporate environment we find ourselves in is very supportive of focused research that contributes to more effective learning, better overall training solutions, and ultimately more satisfied customers. The projects we are currently pursuing include:

The use of self-assessments in Executive education courses – looking at student perceptions of learning, and actual conceptual learning in courses that use embedded self-assessments.

Self-regulation in self-paced e-learning – how can we better support learners through the instructional design and technical features of an online course?

The use of blended learning solutions – when should students interact asynchronously? When should the course include synchronous meetings? Should part of the training be implemented face-to-face?

Social interaction in online learning – when should social interaction be used in an online course? What conditions should be considered when choosing specific instructional methods?

### **Conclusion**

In closing, we have found that several course instructional models have been effective in creating Executive Education courses that are based on solid instructional theory, that students like, and that actually teach students the course content. Creating effective, engaging courses is challenging and difficult. Following solid instructional design blueprints while still allowing for appropriate divergence and variability based on content, student, and client needs has been a successful strategy for us. We are continuing to study the course models and essential course features we have created and used in our attempts to understand and implement the most effective instructional approaches for business audiences. Expanding our instructional design research to include the emerging issues and concerns of business-focused e-learning promises to be an enjoyable and rewarding venture, in both a theoretical and practical sense. The opportunities are endless.

### **References**

Beatty, B. J., Wilson, J., and Branon, R. (2001, October). Embedded self-assessments in executive education courses: Improving participant learning and perceptions of course quality. (pp 60-61). Proceedings of WEBNET 2001, Orlando, FL.

Bruner, J. S. (1990). Acts of Meaning. Cambridge, MA: Harvard University Press.

Dewey, J. (1897). My pedagogic creed. School Journal, 54, 77-80.

Gilbert, L., & Moore, D. R. (1998). Building interactivity into web courses: Tools for social and instructional interaction. Educational Technology, 38(3), 29-35.

Hannafin, M. J., Hill, J., & Land, S. (1997). Student-centered learning and interactive multimedia: Status, issues, and implications. Contemporary Education, 68(2), 94-99.

Merrill, D. (2000). First Principles of Instruction. Paper presented at the annual meeting of the Association for Educational Communications and Technology (AECT), Denver October 28, 2000.

Rogoff, B. (1990). Apprenticeship in thinking: Cognitive development in social context. New York: Oxford University Press.

Savery, J. & Duffy, T. (1996). Problem-based learning: An instructional model and its constructivist framework. In B. Wilson (Ed.), Constructivist learning environments: Case studies in instructional design (pp. 135-148). Englewood Cliffs, NJ: Educational Technology Publications.

Schunk, D. H., & Zimmerman, B. J., eds. (1998). Self-regulated learning: From teaching to self-reflective practice. New York: Guilford Press.

Stone, C. A. (1993). What is missing in the metaphor of scaffolding? In E. A. Forman, N. Minick, & C. A. Stone (Eds.), Contexts for learning: Sociocultural dynamics in children's development. Oxford: Oxford University Press.

Trentin, G. (2000). The quality-interactivity relationship in distance education. Educational Technology, 40(1), 17-27.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University.

# **Systems Design: An Analysis of the Implementation Process of Taiwan's Constructivist-Approach Elementary Mathematics Curriculum**

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## **Abstract**

*The purpose of this paper is to analyze the implementation process of Taiwan's constructivist-approach elementary mathematics curriculum in terms of Reigeluth's guidelines for the system design process.*

## **Introduction**

The implementation of Taiwan's nationwide constructivist-approach elementary mathematics curriculum has been ongoing for five years. Not surprisingly, as time passes, problems related to this implementation process become increasingly evident. This situation is complex because it not only reveals those difficult issues directly related to the epistemology and instructional methods of mathematics, but also, more seriously, those ones associated with the troubles of Taiwan's entire educational system. From the perspective of systems thinking, Taiwan elementary educational system's mindset as a whole is troubled, and is unable to coordinate with the surrounding community in order to better educational standards.

Taiwan's case is worth examination as it serves as an exemplary case of difficulties associated with the redesign of an educational system. The goal of this paper is to analyze the problems linked to the reform and implementation of Taiwan's elementary constructivist mathematics curriculum. This paper will begin with a brief introduction on the new trend in Taiwan's elementary constructivist mathematics curriculum. I will then discuss the difficulties associated with implementation, and the problems caused by those persons in the education community who have a distorted perspective on the reform. Finally, I will examine these problems utilizing Reigeluth's guidelines for the system design process for more comprehensive and systemic understanding of the situations.

## **An overview of the new trend in Taiwan's elementary mathematics curriculum**

Moving away from the objectivist tradition of didactic and authoritative mathematics education, the Republic of China's Ministry of Education mandated a constructivist approach to the province's elementary mathematics curriculum agenda (Ministry of Education, R.O.C., 1993). Taiwan's elementary mathematics curriculum adopts two major views of constructivist approach: the individual cognitive mainly driving from Piaget (1977) and his followers, and social-cultural mainly driving from Vygotsky (1978) and his followers (Taiwan Province Public School In-Service Teacher Training Service, 1995).

Individual cognitive view "...emphasizes the constructive activity of the individual as he or she tries to make sense of the world. Learning is seen to occur when the learner's expectations are not met, and he or she must resolve the discrepancy between what was expected and what was actually encountered. Thus, the learning is in the individual's constructions as he or she attempts to resolve the conflict, or alternatively put, individuals literally construct themselves and their world by accommodating to experiences...From this perspective, the importance of the teacher and other students is as a source of perturbation or puzzlement as a stimulus for the individual's learning...Hence, within this framework, the focus is on the individual within the group, and cognition occurs in the head of the individual." (Duffy & Cunningham, 1996, p.175)

Social-cultural view "...emphasizes the socially and culturally situated context of cognition...This approach examines the social origins of cognition, for example, the impact of an individual's appropriation of language as a mediating tool to construct meaning. Collective actions become the focus, as in Rogoff's (1994, p. 209) learning communities, where 'learning occurs as people participate in shared endeavors with others, with all playing active but often asymmetrical roles in social-cultural activity.' It is the changes of ways in which one participates in a community which are crucial, not individual constructions of that activity...Learning, then, is a process of acculturation, and thus the study of social and cultural processes and artifacts is central..." (Duffy & Cunningham, 1996, pp.175-176)

Publishers designed their elementary mathematics instructional methods based on these two approaches. These instructional methods were implemented nationwide in 1996, beginning with first-grade students.

## Examining the problems of implementation

Since 1996, obstacles faced by proponents of reform have become increasingly great. These problems have already hindered the reform's effectiveness, and have even distorted the Ministry of Education's original intentions (Chen, 2001; Chen, 2001; Huang, 2001). As a matter of fact, the original intentions of this reform were to provide learners with opportunities to truly understand mathematics, to discuss mathematics and to collaborate in efforts to solve problems, just as the community of mathematicians did (Huang, 1996). Unfortunately, such intentions did not come into fruition, as many teachers rejected the new instructional methods (Chen, 2001; Chen, 2001; Huang, 2001). Opposition was so great that there were even teachers who planned an early retirement in order to avoid change. A significant number of people in the education community (By this term, I mean officers, professors of education, researchers, and teachers not directly involved in this reform) were unaware of this nationwide mandatory reform. Many parents were against it, and most community members, like those in the education community, did not know of it.

The obstacles above are by no means caused only by issues of the constructivist instructional method itself. They are closely linked to the issues of systemic thinking and the system design process. Due to the lack of insight in viewing this reform as one related to a systemic transformation (a systemic design and implementation process), this reform has encountered enormous obstacles. The current reform of Taiwan's elementary curriculum, like many other past educational reforms, has fallen into the rut of using a piecemeal approach in a desperate attempt to improve fragmented and outdated educational reforms. If educators truly wish to succeed in creating a better educational program, they must abandon such an antiquated approach and instead, focus their attention on the systems design approach.

One must understand that the reform of one or two educational paradigms often affects other aspects of the educational system. The reform of Taiwan's elementary mathematics education is no exception. As Reigeluth states:

For a fundamental change in education to be lasting and effective, it must be a systemic transformation—one in which changes pervade all aspects of the educational system to account for inter-dependencies among parts of the system. If the change is truly pervasive, it will have an impact, not only on learning in the classroom, but throughout the school and administration, as in the community where it occurs. (Reigeluth, 1990, p. )

The systems design approach directs educational systems design toward a sweeping, comprehensive transformation. Unless we use a systemic approach to review the problems and solutions, we will not be able to give appropriate suggestions for solutions.

In the following section I will use Reigeluth, Norris, and Ryan's "Major Guidelines for the Redesign Process" to analyze the design and implementation of Taiwan's elementary constructivist mathematics curriculum. I believe this approach will guide our mindset to view Taiwan's case in a radical yet systemic way, and help us to build a more comprehensive blueprint for restructuring the educational system so that it may support a constructivist mathematics instruction.

## Analysis

*Table 1: MAJOR GUIDELINES FOR THE REDESIGN PROCESS*

(Adopted from Reigeluth, 1991, p. 9)
<b>Guidelines</b>
Initiating the process:
1. Appraise the climate for systemic change.
2. Make sure you have powerful instigation.
3. Build a school and community coalition of restructurers.
4. Build public support for the change.
5. Document the experience from the beginning.
Design the new system:
6. Involve all stakeholder groups in deciding on and carrying out the design process.
7. Get good leadership and outside facilitation.
8. Develop a common mindset for the new paradigm.
9. Design a feasible model for the system.

10. Establish and maintain communication links.
Planning the implementation:
11. Experiment with tryouts and pilots, and make revisions.
12. Designate time and funds to develop and participate in staff development.
13. Designate time and funds to procure learning resources, and equipment and to remodel facilitation.
14. Obtain active resource support from all stakeholders.
Implementing the design:
15. Allow parents to choose to send their children to the new system.
16. Institutionalize the change process with regular formative evaluations by the stakeholders.
17. Maintain communication with stakeholders, non-participants and outsiders interested in systemic restructuring.
18. Allow three years before doing a summative evaluation.

The above chart outlines the eighteen guidelines proposed by Reigeluth, Norris, & Ryan (1991) to direct the four phases of the educational redesign process. In the following section, I will elaborate on the condition for each guideline.

### **Initiating the Process**

#### **Guideline 1: Appraise the climate for systemic change**

Most of the critical players in Taiwan's educational reform did not harbor negative feelings toward the existing system before the reform started; subsequently, they were seemingly unaware of the urgency for a reform of the mathematics curriculum. The motivation for change, in large part, can be attributed to suggestions from two groups: a large number of college-level mathematics education professors and researchers, and a handful of elementary school principals and mathematics teachers who were aware of international trends in elementary mathematics education. These persons proposed to Taiwan's Ministry of Education that Taiwan's official elementary mathematics curriculum be revised; the Ministry of Education authorized them to do so and appointed key figures to edit mathematics textbooks and resources.

Judging from the above, it is apparent that the reform was not a grass-roots action lead by the needs of elementary school teachers, administrators, and parents. Thus, many teachers continue to use traditional instructional methods to teach the new mathematics curriculum. There is no climate for change for the mathematics instructional method, and needless to say, there is no fertile ground for a systemic change of the entire educational system that would support the constructivist mathematics curriculum.

#### **Guideline 2: Make sure you have powerful instigation**

Usually, elementary school principals enjoy a great deal of power because they have been directly appointed by Taiwan's Ministry of Education, not the school board. Moreover, the Ministry of Education authorizes them to decree school policies and the administration of educational reform. As principals, the above tasks constitute their primary job responsibilities, and are the basis for promotions. Therefore, school principals are the ones who are most vocal in their support of educational reforms. In contrast, staff members, general administrators and teachers tend to be passive because of their fear of change and their unwillingness to accept the additional burdens associated with such change. Consequently, the principals often have a difficult time finding teachers willing to participate in the reform. Principals often try to find highly motivated and respected teachers to serve as instigators of the reform. If the principals are unable to persuade a sufficient number of such educators, they often order young teachers, who tend to be more obedient to the principal than experienced teachers. In Taiwan, community members (parents, business leaders and other influential persons) seldom become involved actively in school activities. The bulk of school funding comes from central and local taxes, not from businessmen's donations.

#### **Guideline 3: Build a school and community coalition of restructurers**

As stated above, community members were far removed from school activities; therefore, there were virtually no partnerships between schools and community members in the school reform process.

#### **Guideline 4: Build public support for the change**

Reform took place almost completely in professional, educational circles. Community members, even the students' parents, did not know much of the reform. Over the past few years, the media has only sporadically reported these events; such issues tended to appear solely in scholarly periodicals that deal with education. Meanwhile, the constructivist mathematics curriculum quietly developed on school camp uses.

#### **Guideline 5: Document the experience from the beginning**

Taiwan's official model of constructivist mathematics curriculum was tested in several schools over a four-year period before it was deemed fit for application nationwide. A great deal of qualitative and quantitative research has documented the different phases of implementation, for example: teachers' changes in pedagogy (Ko, 1996), the process of instruction (Tzeng, 1997), and students' achievements and shifting attitudes toward mathematics (Chung, 1997). The research results came in both print and non-print forms, and were quite useful. Unfortunately, because of limited quantity and circulation, teachers, parents and administrators did not have many opportunities to access them.

#### **Designing the new system**

#### **Guideline 6: Involve all stakeholder groups in deciding on and carrying out the design process**

As stated above, only a few mathematics professors, researchers, administrators and teachers initiated and developed this new curriculum. The stakeholder groups in the majority of schools were not involved in the design process. Thus, they were neither familiar with nor enthusiastic about the reform; they could not play the role of advocates for the new curriculum.

#### **Guideline 7: Get good leadership and outside facilitation**

Owing to the limited number of persons trained in the new curriculum, there were not enough teachers to demonstrate it in the 2,583 elementary schools throughout Taiwan. Normally, teachers who were somewhat familiar with the new methods simply would supervise their colleagues, or teachers from the same school would form collective training sessions, through which they could learn from each other.

#### **Guideline 8: Develop a common mindset for the new paradigm**

Unfortunately, most of those involved in the reform viewed it more in terms of curriculum and instructional methods, rather than in terms of a fundamental change of mindset about education. The reformers failed to create a special atmosphere for sharing common values and goals.

#### **Guideline 9: Design a feasible model for the system**

Educators published several instructional models on constructivist mathematics. These models were feasible, and came with teacher's manuals, so they were not too difficult to teach from. However, I think the problems are not in these instructional models, but the problems behind the instructional models and those on the periphery. By "behind," I mean the epistemology and assumption of learning. Peripheral problems are training and diffusion issues. These have been or will be discussed in each guideline, so I will not elaborate on them here.

#### **Guideline 10: Establish and maintain communication links**

Communication links entail internal communications such as holding regular public meetings and utilizing various media, and external communications such as linking up with other schools and joining networks (Reigeluth et al, 1991). Not surprisingly, these links were scarce within schools and between schools.

## **Planning the implementation:**

### **Guideline 11: Experiment with tryouts and pilots, and make revisions**

Among the publications implementing elementary constructivist mathematics, only the textbooks designed and developed by Taiwan's government agency were used in the four-year pilot program. The rest of the textbooks did not go through this process, therefore, they created a significant amount of confusion among teachers. This situation proves that the testing process is necessary.

### **Guideline 12: Designating time and funds to develop and participate in staff development**

Neither substantial time nor sufficient funding has been provided to facilitate the diffusion of the reform.

### **Guideline 13: Designate time and funds to procure learning resources, and equipment and to remodel facilities**

The lack of time and funds was regarded as the most frustrating situation for teachers. Teachers complained that, even though there were enough constructivist mathematics instruction resources for them to use, there was a lack of quality instructional media to go with each lesson in the new curriculum.

### **Guideline 14: Obtain active resource support from all stakeholders**

This reform was mandatory, so all stakeholders were supposed to contribute as many human and material resources as possible to the implementation efforts. Teachers also had the obligation to contribute to the implementation efforts. However, this was a mandatory and not a grass-roots action; as a result, not all stakeholders and teachers were involved in the implementation. Some stakeholders rejected the training and opted for early retirement.

## **Implementing the design:**

### **Guideline 15: Allow parents to choose to send their children to the new system**

Since this reform was mandatory, all Taiwanese elementary schools, private and public, took the identical approach to instruction. Parents did not have a say in the matter.

### **Guideline 16: Institutionalize the change process with regular formative evaluations by the stakeholders**

Reigeluth mentioned three kinds of strategies for this guideline: evaluate the system continuously, include all stakeholders in a shared governance system, and consider an equitable choice plan and incentive system to encourage continual systemic change. I do not know if these strategies occurred in Taiwan's case; I need more time to investigate these issues. Regardless, the reform often times dies off within a few years due to a lack of these strategies.

### **Guideline 17: Maintain communication with stakeholders, non-participants and outsiders interested in systemic restructuring**

Taiwanese schools often are isolated from the surrounding communities. These institutions lack a comprehensive channel of communication between those inside and outside, participants and non-participants, or even among stakeholders. Schools tend to introvert themselves, and this closed system is not conducive to reform.

### **Guideline 18: Allow three years before doing a summative evaluation**

To my knowledge, there is no plan yet to conduct a nationwide formative or summative evaluation of this reform. Small-scale formative evaluations on students' achievements in mathematics and attitudes toward the new curriculum were carried out (Chung, 1997).

## Conclusion

In this paper, I started with the significance of the study of the implementation of Taiwan's constructivist-approach elementary mathematics curriculum. I briefly described its new trends and revealed the problems related to such educational reform by examining the difficulties associated with the implementation of this curriculum. In order to achieve an appropriate perspective to view these problems, it was necessary to utilize a systems design approach rather than a piecemeal approach. Reigeluth's guidelines for the design process were used to analyze the situation. These guidelines guided us to view these situations both comprehensively and systematically through four phases of design process. Therefore we did not miss any essential process to be trapped into a partial perspective, like the blinds touched an elephant. Further, they will continue to guide us on how to take action for future reform action.

## References

- Chen, H. L. (2001, February 16). Hai tzi pian pen le? Ko hsiao chien ko shih hsu hsueh hsian lun cheng (Have children become ignorant? War on constructivist-approach elementary mathematics). The United Evening News.
- Chen, R. Y. (2001, February 18). Chien ko shih hsu hsueh lo shih chia chang yi to wu hsuei (Constructivist-Approach mathematics makes teachers and parents confused). Chung-Kuo Shih Pao.
- Chung, C. (1997). Shu hsueh chiao shih wenhua te hsin mao (The new image of mathematics classroom culture). In Taiwan Province Public School In-Service Teacher Training Service (Ed.), Kuo min Hsiao hsueh shu hsueh hsien ke chuen kai shuo (Introduction to public elementary school new mathematics curriculum). Pan Chiao, Taiwan, R.O.C.: Taiwan Province Public School In-Service Teacher Training Service.
- Duffy, T. M. & Cunningham, D. (1996). Constructivism: Implications for the design and delivery of instruction. In D. H. Jonassen (Ed.), handbook of research in educational communication and technology (pp. 170-198). New York: Macmillan.
- Huang, F. C. (2001, February 23). Chien ko shih hsu hsueh ai hong (Constructivist-approach mathematics received criticism). The United Evening News.
- Huang, M. (1996). Elementary school mathematics education in Taiwan. Unpublished manuscript, National Taiwan University, Taipei, Taiwan, R.O.C.
- Ko, T. (1996). Problem-solving behavior and the process of consensus development: a study of children's mathematical discussion. Unpublished master's thesis, National Pingtung Teachers College, Pingtung, Taiwan, R.O.C.
- Ministry of Education, R.O.C. (1993). Kuo min hsiao hsueh ke cheng biao chuen (The curriculum standards of public elementary school). Taipei, Taiwan, R.O.C.: The author.
- Ko Li Pien Yi Kuan. (1998). Kuo min hsiao hsueh hsien ke cheng ti nien chi shu hsueh ko chiao ko shu shih yung yi chien tiao cha yen chiu: pa shih chi hsueh nien tuyen chiu pao kao (Research on the survey of the use of 1st-to-2nd-grade new mathematics textbooks: 1998 academic year research report). Taipei, Taiwan, R.O.C.: The author.
- Piaget, J (1977). The development of thought: equilibration of cognitive structures. New York: Viking.
- Reigeluth, C. M., Norris, C. A., & Ryan, D. F. (1991). School Improvement Resources Inquiry- United States of America : A national study of school restructuring. Report II: Synthesis. (Available from the School Restructuring Consortium, Room 2236, School of Education, Indiana University, Bloomington, IN 47405)
- Taiwan Province Public School In-Service Teach Training service. (1995). Kuo min hsiao hsueh hsien ke cheng biao chuen te ching shen yu te se (The essence and characteristics of the new curriculum standards of public elementary school). Pan Chiao, Taiwan, R.O.C.: The author.
- Tzeng, J. (1997). Social interaction and the construction of mathematical knowledge: in ethnographic study of a third-grade mathematical classroom. Unpublished master thesis, National Chiayi Teachers College, Chiayi, Taiwan, R.O.C.
- Vygotsky, L. (1978) Mind in society. Cambridge, MA: Harvard University Press.



# **Integrating Technology and Inquiry Pedagogy: Needs-Based Professional Development**

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## **Introduction**

In recent years, academic deficiencies of U. S. science students have been of primary concern to both the U. S. Department of Education (Henry, 1997) and the National Research Council (NRC) (1996). More specifically, Georgia students scored in the lowest 25% of students tested in 40 states and 51% scored at the “below basic” level of understanding science. In light of such reports, strategies to improve science teaching and learning have become a focus of professional development efforts around the country.

Due to the dynamic nature of teaching and learning science in our modern, technological world, it would be reasonable to assume that teachers, not just their students, should be dedicated learners. The job of teaching must be redefined to include continuous teacher learning (Berlin, 1996). According to the National Science Education Standards (NSES) (1996), learning has a two-fold purpose in science education: (1) to keep current in science and (2) to deepen the understanding of effective science teaching strategies. Such educational strategies should be aligned with the NSES to include science as inquiry, utilization of technology, and collaboration among educators. Additionally, successful professional development activities provide explicit connections to teacher needs as well as a sense of ownership in the learning process.

The NSES clearly outlined objectives for teaching and learning science. Paramount to all science education was science as inquiry. Inquiry, the watchword of constructivist reform, dictates that any knowledge and understanding must be (1) actively acquired; (2) socially constructed; and (3) created and then recreated for individualized meaning (Perkins, November 1999). NSES guidelines vary greatly from the passive mode of learning that pervades education today, and logically teachers would require substantive support and education to master the inquiry techniques advocated.

As students become more fluent with technology, it is imperative that educators, as well, increase their technological comfort level and rise to meet the needs of their students. According to Jane Healy, as cited in Tell, (October, 2000), technology is a great gift to education and affords teachers and students opportunities to initiate important learning. Such learning, while easily aligned with constructivist ideals, must be planned and guided by teachers. Fundamental, then, to any professional development effort is providing school staff with ongoing training to increase teacher fluency as well as link technology with authentic work (Dooling, October, 2000).

Finally, as mandated by the NSES, collaboration should be at the heart of teaching and learning. As mentioned previously, constructivist learning is a highly social process. Knowledge and understanding for students and teachers are constructed in dialogue with others (Perkins, 1999).

A regional university of the University System of Georgia, Valdosta State University (VSU), fulfills the academic needs of the South Georgia area. The area serviced by VSU contains a high proportion of minorities and students from economically disadvantaged families. Student performance on the state mandated science assessment, the Georgia High School Graduation Test, was well below achievement levels compared other subject areas (Georgia Department of Education, 1999). VSU must reach out to science teachers in the area to improve teaching skills if their students are to become productive, contributing members of local communities. It was with these needs in mind, that the inquiry learning and technology utilization project for middle grades and high school teachers was developed.

The educational significance of this study was to advance the existing body of knowledge and improve science classroom instruction by assisting middle and high school teachers to (1) become knowledgeable and proficient with inquiry-based teaching consistent with both state and national education reform efforts (GIMS, 1996; NRC, 1996), and (2) obtain necessary experience and skills to incorporate instructional technologies into the inquiry-based teaching format. Due to the one-year length of the project, teachers were supported through concerns identified with the three distinct stages of change implementation: preparation, acceptance, and commitment (Rogers, 1996; Salisbury, 1996) allowing discipline-wide adoption and considerable change in practice to be achieved.

## **Review of Related Literature**

Worthwhile educational changes require new knowledge, attitudes, and behavior (Fullan, 1991). A striking departure from the classroom norm, constructivist theory and science as inquiry demands the active participation of the learner, not passive receptivity. The authoritative role previously played by teachers has been transformed into one of facilitator (Mancino, 1995). Additionally, while there are growing pressures for teachers to embrace technology in the classroom, where there exists no specific mandate to do so, there will be continued reluctance on the part of teachers to change from what is familiar and comfortable (Robinson, 2000).

## **Professional Development**

Dorit (1999) hypothesized that professional development programs should put teachers in the role of learners in an attempt to facilitate epistemological change and influence their use of technology and constructivist teaching practices. Within the realm of a multimedia constructivist program, science teachers worked cooperatively, with minimum supervision, and conducted investigations regarding the utilization of a multimedia package in their classroom. The study suggested that collaboration, time for reflection, and active teacher participation as learner all contributed to the success of inquiry-based learning and a change in teacher thinking.

Effective professional development for science education should draw from a synthesis of standards posited by the NRC (1996) (Loucks-Horsley, Stiles, and Hewson, 1996). Included in these standards is the development of a learning community. Stein (1998) provided a view of professional development at its best: a systemic investment in building teacher capacity through collaboration. In this case, professional development was seen as everyone's job and everyone viewed themselves responsible not only for their learning but also for the learning of colleagues. Such a collaborative effort led to teacher change, a newly implemented constructivist approach to teaching and learning, and improved student performance district-wide.

Teachers, like students, learned science as inquiry best by doing science as inquiry by investigating for themselves, and building their own understanding (Supovitz, Mayer, and Kahle, 2000). A standards-driven inquiry-based professional development effort in Ohio produced strong, positive, and significant growth in teachers' attitudes toward inquiry-based instruction, as well as their use of inquiry in the classroom. Not only did change occur, it was sustained for up to three years following involvement.

In a five-year, longitudinal study, Berlin (1996) evaluated the effects of action research on teacher attitude toward inquiry, as well as improved teaching and learning. Berlin's model mimicked the stages of the learning cycle: Awareness, Research and Development, and Application. Not only were science educators introduced to the philosophy of science as inquiry, professional development strategies were inquiry-based. To repeat, teachers learned inquiry by doing inquiry. Quantitative and qualitative data suggested that inquiry-focused action research enhanced teacher attitudes towards both educational research and inquiry-based instruction. Additionally, action research facilitated the implementation of educational innovations in the classroom and improved teaching and learning.

The results of past learning cycle institutes, sponsored by the National Science Foundation, have documented long term changes in teaching strategies of the participants (Marek, Haack, and McWhirter, 1994). Most significantly, 93% of participating science teachers continued to use learning cycles in their science programs nearly a decade after the institute. Teachers stated that the learning cycle procedures:

- Involved students actively in the learning process
- Produced deeper understanding and greater retention of concepts
- Developed students' thinking and communication skills
- Included teaching process as well as content
- Made science relevant and meaningful to students.

As mentioned previously, teachers learned inquiry by doing inquiry. If, indeed, the learning cycle so greatly impacts student learning, one would expect similar results on teacher learning as well.

## **Methods and Procedures**

### **Participants**

The participants of the research project included 50 public school teachers from four counties in South Georgia, certified to teach either middle grades or high school science. A Florida group included 20 teachers certified to teach grades 4 – 12.

### **Procedure**

Exploration phase. Science teachers met for five days during the summer from 9 a.m. to 3 p.m. During the first ninety minutes they attended seminars lead by science education professors to examine (a) the structure of science; (2) the nature of human learning; and (3) authentic assessment strategies for student evaluation in learning cycle curricula. Teacher-participants spent the rest of each day in laboratory session lead by project staff. These sessions included (1) technology activities designed to familiarize teachers with the use of various educational technologies and (2) science laboratories modeling the learning cycle procedure led by in-service middle and high school teachers experienced in inquiry teaching.

Application phase. Once school started in August, teacher-participants met with project staff every alternate Saturday for eight weeks from 8 a.m. until 3 p.m. Teachers received copies of learning cycle curriculum, and with the assistance of project staff, modified two weeks of current science curriculum into inquiry-based lessons. Successes and difficulties of implementation were discussed on a regular basis.

Follow-up phase. For the remainder of the school year a member of the project staff conducted four observations of each participating teacher utilizing the learning cycle in the classroom. Following each observation, a meeting between teacher and staff member was conducted to discuss implementation of inquiry-based teaching procedures, incorporation of technology, assessment, or other factors associated with teaching change. In addition to individual meetings, two meetings with all teachers and project staff were conducted to brainstorm solutions to problems and to share successes.

## **Instrumentation**

An Advisory Panel, consisting of a scientist, educational technologist, certified Teacher Support Specialist, two middle school and two high school teachers, and two science education professors, developed a preliminary survey administered previous to participation in the summer workshop and designed to measure teacher attitudes and pedagogy. A follow-up survey was designed to measure attitudinal change immediately following the Saturday workshops. Teacher observations were conducted using a checklist developed in conjunction with survey data and teachers submitted reflective responses during follow up sessions. Student achievement was ascertained via pre and post subject-matter tests administered by participating teachers.

## **Results**

### **Students**

Student pre and post-test data indicated adequate to high levels of science achievement. More importantly, teachers noted, via reflective writings, an increase in student enthusiasm. Students appeared genuinely eager to be engaged in science and actively participated in providing suggestions for classroom investigations. One teacher noted how the inquiry format facilitated learning for all students. Non-reading middle grade students could readily participate in hands-on science activities while she monitored their learning through performance based assessments rather than traditional paper-and-pencil items. Another teacher commented on the development of classroom cooperation through increased use of inquiry activities. Inclusion students, usually excluded from science learning due to the traditional lecture format, were now able to actively participate within cooperative inquiry groups.

The spirit of cooperation and inquiry spilled over into other learning opportunities as well. A student in a tech-prep biology class instructed classmates how to use PowerPoint to present data collected during an inquiry activity while another student taught classmates in ecology how to use the school's digital camera to record data for a science investigation. Cooperative activities lead to instances of shared responsibility in other areas as well. When a student acted inappropriately on the school grounds while looking for rocks, the teacher took that opportunity for the class to look for solutions to resolve the incident.

At first glance, many classrooms seemed noisy and disorderly. In reality, after implementing inquiry activities and increasing student input, teachers had fewer discipline problems. Active engagement in learning science really was just that and students who were busy doing science did not have time to cause problems.

### **Teachers**

Teacher response was overwhelming positive. Answers to attitudinal survey questions ranged from "agree" to "strongly agree". Not only did the participants state that the professional development addressed their needs, they also stated at the end of the weeklong meeting, that they agreed with the educational approaches presented and

would be able to incorporate both inquiry and technology into their daily lessons. Individual comments included such things as “empowering”, “energizing”, and “a reminder that science is supposed to be active and exciting”.

Additional meetings and correspondence with teachers indicated unwavering support. At the initial 2-week interval meeting, one group of middle school teachers had converted 10 weeks of lesson plans to inquiry format. Lack of textbook support materials caused some teachers to voice concern, but the support of the project’s master teachers spurred them on the inquiry path. One early disbeliever, by the third meeting, had taught an entire three-week science unit using the inquiry format. She gave credit for her conversion to the master teacher who helped her design the unit.

If there was a single result that stood out among all others it was the evolution of teachers to teacher-collaborators. After the summer session, teachers shared a vision of change in the science classroom. Incorporating technology and modifying existing curricula to an inquiry format is a huge task for one person. Recognizing that there is strength in numbers and acknowledging the skills of some to lead the way, the groups of teachers from each system became collaborators. As 2002 is also science textbook adoption year, teachers have decided to collaborate on the selection of textbooks to facilitate incorporating the goals of this project. There are plans to develop a web site for sharing of ideas and inquiry formatted lesson plans as well.

Individually, one teacher commented on how the newly generated student enthusiasm for science as energized her as well. A physical science teacher discussed how this format seemed more efficient to her since many of her students rarely read the material in the text anyway. Once their interest was piqued by the inquiry activities, they were more likely to go back and read pertinent textual information. Another science teacher recently relegated to P.E. duty, incorporated inquiry activities into the health/P.E. arena by guiding students through an investigation of respiration, pulse rate, and physical activity. She commented on what a great opportunity that provided for integrating health, science, and mathematics in an otherwise academic-free zone.

On a broader scale, teachers acknowledged the importance of the support offered by the project staff. One teacher commented on previous staff development activities: “They spend a day or two with you and then they leave. You don’t know what to do and no one else does either.” In contrast, the continued support by the project leaders in this instance was empowering. The same teacher added: “I know I can count on this group (project leaders) if I need help.”

The support by the project members and co-workers has inspired several veteran teachers to venture into uncharted territory. Traditional lecture-driven classrooms were coming alive with the noisy hum of inquiry activities. Teachers who never wanted a computer in their room now were asking for several student computers to be installed. One school system, in support of their science educators, applied for and received a \$125,000 math and science technology grant. This money will be spent on installing a presentation station in each science classroom as well as purchasing a set of 15 laptop computers with Internet access.

## **Conclusion**

Transformation may be the watchword of education today. As we charge into the information age, priorities and paradigms shift. What was valued a few decades ago, mass-produced knowledge, has been replaced by individually constructed knowledge. Active replaces passive. Teachers, too, must become active learners to master the changing scene in education, a scene that requires science as inquiry and the integration of technology. The key concepts described in the NSES formed the foundation for this project through the use of inquiry-based learning cycle teaching procedures, technology integration, and system-wide collaboration of science teachers. Worthwhile educational change requires new knowledge, attitudes, and behaviors (Fullan, 1991). The inquiry-technology integration project seemed to effectively supply these key requirements to science educators in South Georgia.

## **References**

- Berlin, D. P. (April, 1996). Teacher action research: The impact of inquiry on curriculum improvement and professional development. ERIC Document Reproduction Service No. ED 397 029.
- Doolling, J. O (October, 2000). What students want to learn about computers. *Educational Leadership*, 58. (2), 20-24.
- Dorit, M. (August, 1999). Teachers-as-learners: The role of a multimedia professional development program in changing classroom practice. *Australian Science Teachers Journal*, 45. (3), 45-51.
- Georgia Initiative in Mathematics and Science (GIMS). (1996). *POET: Principles of educating teachers of mathematics and science*. University of Georgia Publication.

- Georgia Public Education Report Card. (1998-1999). [On-line] Available <http://accountability.doc.K12.ga.us/>
- Fullan, M. (1991). *The new meaning of educational change*. London: Cassell.
- Henry, T. (October, 1997). Most kids have basic but not working science knowledge. *USA Today*. P. 9D.
- Loucks-Horsley, S., Styles, K., & Hewson, P. (1996). Principles of effective professional development for mathematics and science education: A synthesis of standards. ERIC Document Reproduction Service No. Ed 409 201.
- Mancino, J. S. (1995). Curriculum policy making for the global economy: The road not taken. ERIC Document Reproduction Service No. Ed 3878 896.
- Marek, E. A., Haack, C., & McWhirter, L. (1994) Long-term use of learning cycles following in-service institutes. *Journal of Research in Science Teaching*. 5 (2), 48-55.
- National Research Council (NRC) (1996). *National science education standards*. Washington, D. C.: National Academy Press.
- Perkins, D. (November, 1999). The many faces of constructivism. *Educational Leadership*. 57 (3), 6-11.
- Robinson, B. (2000). Teaching teachers to change: The place of change theory in the technology education of teachers. [On-line] Available [http://www.coe.uh.edu/insite/elec\\_pub/html1995/0311.htm](http://www.coe.uh.edu/insite/elec_pub/html1995/0311.htm)
- Rogers, E.M. (1995). *Diffusion of innovations* (4th Ed.). New York, NY: The Free Press.
- Salisbury, D. F. (1996). *Five technologies for educational change*. Englewood Cliffs, NJ: Educational Technology Publications.
- Stein, M. K. (March, 1998). High performance learning communities district 2: Report on year one implementation of school learning communities. ERIC Reproduction Service Document No. ED 429 263.
- Supovitz, J. H., Mayer, D. P., & Kahle, J. B. (July, 2000). Promoting inquiry-based instructional practice: The longitudinal impact of professional development in the context of systemic reform. *Educational Policy*: 14(3), 331-357.
- Tell, C. (October, 2000). The I-generation- From toddlers to teenagers: A conversation with Jane M. Healy. *Educational Leadership*. 58 (2), 8-15.

# **Integrating Internet-based Learning In An Educational System: A Systemic Approach**

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The first time we taught an online class, we didn't tell anybody that was what we were going to do. In 1996 when we first conceived of teaching a class on internet-based learning using the medium of internet-based learning, we weren't entirely sure how we would go about it. And given the myriad of rules and regulations associated with public higher education such as contact hours, new course approvals, and teaching evaluations as they relate to tenure and promotion, we thought it best that we keep things quiet less they go very, very wrong. Whether or not our first class went very, very wrong is open to debate, but our online course is no longer a secret (Harmon & Jones, in press; Harmon & Jones, 1999; Jones, Harmon, & Lowther, 2002; Jones & Harmon, In Press). Online courses are being taught at established universities and newly founded virtual universities. Department chairs, Deans, and Presidents are all anxious to put classes online. Position announcements specifically request people with online teaching experience, and course loads are defined by online courses. For better or worse, online courses are here, apparently to stay, and university teaching may be fundamentally changed as a result.

But teaching is only one part of higher education. For those of us working in the academy, we recognize immediately that what we teach and how we teach impacts our time and resources. And time and resources impact everything else we are asked and required to do. Consequently a fundamental change in teaching will also change how we do other things in higher education, such as research and service.

While we have defined varying levels of Web-based instruction (WBI) (Harmon & Jones, 1999), here we would like to take a broader look at WBI as it applies to higher education. Specifically, we are attempting here to define the educational system under girding higher education. Our purpose here is to identify the various components of the system to illustrate how and where they interact, overlap, and come together so that we may better understand how WBI may impact higher education. To that end, we must first define an educational system in order to define our educational system, higher education.

## **Defining an Educational System**

Banathy (1995) argues that modern society imposes on us complexities that cannot be dealt with by traditional reductionist methods of science. In this era of rapid information flow human systems interact with their environment in fluid and dynamic ways. There are too many interacting variables to allow easy problem solving; perhaps the best we can hope for is "problem management." But in order to achieve even this level of control we must first understand our systems and how they operate. This need becomes even greater in light of the additional complexity potential resident in the vast, chaotic amalgam that is the World Wide Web. Realizing that entire textbooks have been written on systems and systems theory (i.e. Banathy, 1968; von Bertalanffy, 1968), our goal here is to provide a few simple guidelines for consideration when implementing WBI.

### **Principle 1: A system is a set of organized components working toward a common goal.**

Every educational system is working towards a common goal, whatever that goal may be (Banathy, 1991). For a corporate environment, that goal may be to increase revenue. If we consider a retail environment for a moment, the training of new sales people will put more people on the floor working with customers effectively, which may increase customer satisfaction, which can generate increased sales, which in turn drives profits and ultimately corporate revenue. But training can be costly for the company. The organization must pay not only the wages of trainers and students, but also the costs of developing the training and the associated costs of travel, lodging, per diem and lost productivity. An organization must decide, based on its goals, what training should look like, how much it can cost, and how ultimately it meets the goals of the system. Being able to align strategic goals and missions of the system to the training environment, assures replicability, and allows for precise troubleshooting when some component of the instruction fails (Dick & Carey, 1996).

**Principle 2: A change to one component of a system may cause a change in every other component of that system.**

Understanding this idea is central to an effective use of Web-based Instruction. For most of us, WBI is a very different way of doing business than that to which we are accustomed. When we make the often radical change to WBI we run the risk of causing drastic changes in the rest of our organization. Offering a course on the Web requires us to reconsider aspects of the system that we often take for granted. How will the change affect textbooks? What will become of custodial services? What happens to corporate and university libraries when students are no longer on campus? Will scheduling change from the purview of facilities to the purview of information systems? These and numerous other issues will need to be considered. Remember the lesson of chaos theory, that a butterfly flapping its wings in Brazil can create a hurricane in Texas (Gleick, 1987), only changing to WBI is not so much like a butterfly flapping its wings as it is a jet plane revving its engines.

**Principle 3: Every educational system is different.**

While general systems theory holds that there are elements common to systems, every system is unique. Every system has particular features about it that provide its strengths and weaknesses. There do exist macro level pieces of a system that may be common to any educational system. Students, instructors, assessment, delivery, and management can be common to all environments. However, different environments will have different requirements. For example, the instructors in a corporate environment may have no other responsibilities beyond those associated with the classes they teach. In higher education, however, instructors often have not only teaching responsibilities, but research expectations and committee assignments as well. While both may be involved in instruction, the other components of the system will vary. Analysis of your own system and its particular requirements is important to before training begins.

It is important to note that we are working within the framework of Higher Education here. While we have written on WBI in other environments, (Jones, Harmon, & Lowther, 2002) we are writing here specifically to higher education. We chose higher education as an example for a number of reasons. One, it is an environment that we work in and understand. Two, it is an environment that is often imitated in other educational institutions. We feel that much of what we say could apply to any educational system, but because of space we'll limit our discussion to a university environment.

**Defining the mission**

To begin, we focus not on student learning, but on the mission of the institution, whatever it may be. All components of the system should work together to promote this mission. Student learning may represent only one part of it. We divide our model into four primary components, three of which are based on the common faculty perspective of the mission, namely **teaching**, **research** and **service**, supplemented by the fourth factor, **management**.

**Teaching**

The teaching component includes everything having to do with students, ranging from public relations, which might include such things as athletic teams, to on-campus housing, dining, and transportation systems. We believe that we can capture the complexity of this component with three primary elements. (See Table 1) Note that as with all other pieces of our system, activities within one component often overlap with other components.

*Table 1. Elements of the teaching component*

<b>Element</b>	<b>Definitions</b>
Student Recruitment	Deals with attracting students to the university. Impacts student services, quality of academic programs, types of athletic programs and other factors which may influence a student's decision to attend a university.
Student Retention	Keeping students enrolled in the university. Deals with issues such as campus life, academic assistance, and generally keeping the quality of the student experience high.
Student Matriculation	Ensuring that students progress and graduate in a timely fashion. Deals with access to classes and curriculums that are accessible and possible to finish in a

	reasonable amount of time.
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## Research

At many universities the research component may be tacitly viewed as the most important component of the system. Even at primarily teaching institutions, tenure and promotion decisions may rest significantly upon research (Boyer, 1997). The degree to which research is seen as a driving force at a university will vary considerably depending upon the institution's mission and goals. However, research will retain a prominent role in the academic community, and the best researchers will accumulate the most prestige and resources. Table 2 defines major elements of the research component.

*Table 2. Elements of the Research component*

<b>Element</b>	<b>Definitions</b>
Research Funding	Identifying funding sources, writing and obtaining grants. Also includes administration of grants and any profits realized from research.
Research Investigation	Defining and conducting research. The establishment and execution of a productive research agenda.
Research Dissemination	Making public the results of research through journals, conferences, and increasingly, the WWW.

## Service

Service is generally the least rewarded of university tasks but ironically often seems to require the most time. Typically speaking, service happens inside the university, through such outlets as faculty governance, and outside of the university as outreach to the local community or to your community of professionals. Table 3 illustrates the two typical types of university service.

*Table 3. Elements of the Service component*

<b>Element</b>	<b>Definitions</b>
Governance	Participating in the self-governing process by serving on such bodies as departmental committees or the University senate.
Outreach	Service to one's profession or community. This may include such things as holding offices in professional organizations, serving as editors for journals, or volunteering time for professionally related community service.

## Management

The fourth major component of our system is often the least regarded by faculty and students because it appears to have little direct impact on the teaching and learning. However, management serves to insure that the proper resources are available and are applied to the efficient functioning of the other components. Management can be the glue that holds the rest of the system together. Major elements of the management component are listed in table 4.

*Table 4. Elements of the management component.*

<b>Element</b>	<b>Definitions</b>
Faculty & staff recruitment & retention	Locating and keeping qualified personnel. Includes developing and implementing attractive compensation packages. Impacts the institution's reputation.
Logistical operations	The day-to-day functioning of a university. Everything from ordering the right books in the bookstore to making sure the trash gets emptied.
Program Evaluation	Making sure that the system itself is both appropriate and working correctly.
Finance	Finance is an aspect of the management component includes such things as budget, publicity, and alumni relations. Budget is at its most basic, the acquisition and distribution of funds (i.e.



	working with legislatures and donors) and managing tuition, fees, and salaries. Since publicity is usually considered as goodwill and has financial value we include it here. Publicity would include everything from University logos to PR campaigns. Alumni relations involve maintaining contacts with past graduates of the university for purposes of maintaining the reputation of the institution and in attracting donations.
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We propose these areas as an example of the major components of an educational system. Other aspects of the system, such as stakeholders and the interactions among the components are beyond the scope of this paper. While we realize that we have not captured every element of every component, we do feel that these are representative and give us a starting place for looking at how WBI might impact the educational system. However before we look at its impact on the system, we must first look at how the Web might be used within the system.

### Five Levels of Web Use

When faced with the prospect or requirement of using the Web in education, many people assume that they are being asked to create an online environment that will be a stand-alone, self-sustaining educational product. While this may be the goal of some environments, it need not be the goal of all. Harmon and Jones (1999) suggest five levels of use of the Web common in schools, colleges, and corporations. These levels represent a continuum from basic occasional use to advanced continual use. We feel that these levels go a long way towards helping stakeholders understand how the Web might be used in an education or training setting. Each level provides for particular uses and classifications of interaction between the students and teachers, and between the humans and the technology. Table Five defines and summarizes each of the levels.

Table 5. Levels of WWW use in education. From Harmon and Jones (1999).

Level Of Web Use	Description
<b>Level 0:</b> No Web Use	The default level. Implies no Web use at all.
<b>Level 1:</b> Informational	Providing relatively stable information to the student typically consisting of instructor placed items such as the syllabus, course schedules, and contact information. This sort of information is easily created by the instructor or an assistant, requires little or no daily maintenance, and takes up minimal space and bandwidth.
<b>Level 2:</b> Supplemental	Provides course content information for the learner. May consist of the instructor placed course notes and other handouts. A typical example would be a PowerPoint presentation saved as an HTML document and placed on the Web for students to review later.
<b>Level 3:</b> Essential	The student cannot be a productive member of the class without regular Web access to the course. At this level the student obtains most, if not all of the written course content information from the Web.
<b>Level 4:</b> Communal	Classes meet both face-to-face and on-line. Course content may be provided in an on-line environment or in a traditional classroom environment. Ideally, students generate much of the course content themselves.
<b>Level 5:</b> Immersive	All of the course content and course interactions occur on-line. Does not refer to the more traditional idea of distance learning. Instead, this level should be seen as a sophisticated, constructivist virtual learning community.

It is our position that these levels can help any organization define how it plans to use the Web in education. Knowing at which level you are working will help you understand how your work can affect the entire educational system. To illustrate this, we propose a model for considering systemic issues in higher education as they relate to WBI.

### The Model

To illustrate our proposed method for accounting for all systemic issues within higher education as it relates to WBI, we offer the model shown in Figure 1. The model can be read by taking each component of a higher education system, teaching (T), research (R), service (S), and management (M) and filtering it through the five levels of WBI, represented numerically. It is possible to take a single component of the system and run it through all levels or a single level. Likewise, the entire system can be run through a single level or through all levels collectively.

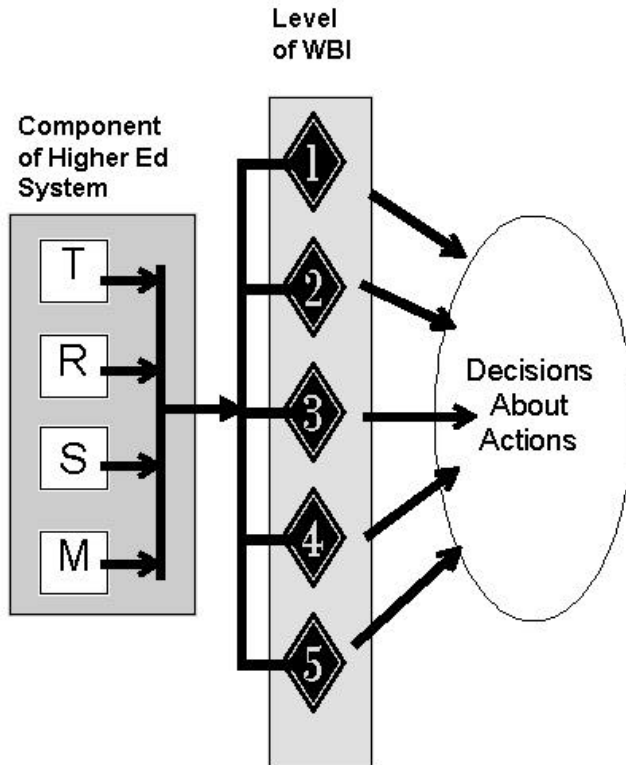


Figure 1. A model used to address Higher Education System Components as they relate to WBI.

To further explain how the model might be used, we will take each component of a higher education system and discuss it as it relates to each of the five levels of WBI, excluding Level 0. It should be noted that we would recommend a careful analysis of your individual environment. What we provide in the following pages is a generic discussion of issues in a higher education system as they relate specifically to WBI.

### Level 1: Informational Web Use

The easiest level to reach, informational use of the Web may make the greatest impact on the Management component. Teaching itself may not be impacted greatly, but student's decisions on courses may. This level involves merely providing basic information to stakeholders via the Web

#### Teaching

Students today are thought of as consumers. Before they spend money on a class, or make a decision on a degree program, they may do considerable research. While putting a syllabus online may not impact instruction much, it will impact access to course information. This may provide better visibility to low enrollment classes or provide general publicity for a particular degree program. It may also impact faculty time and teaching expenses. Because the course syllabus is online, faculty do not have to spend as much time answering questions about classes to prospective students, or students may have more focused questions for the faculty member.

#### Research

At this level, research may not be impacted greatly for the faculty member, but institutional research could have a field day. Data could be tracked on the relationship of access to syllabi to course enrollment and course evaluations. This is the kind of data that can help justify technical and support positions as well as capital upgrades to aging computing infrastructure. In addition, the university may wish to provide an online listing of faculty research interests, perhaps thereby generating some research opportunities, fostering collaborations, or providing assistance in research funding.

## **Service**

While level 1 may impact committee work slightly (i.e. in terms of organizational charts and committee memberships placed online), the greatest impact on service at this level may come to faculty who specialize in technology. Technology faculty, (i.e. faculty in Instructional Technology, Information Science, or Computer Science), are often asked to take on the responsibility of creating and maintaining programmatic Web pages. The danger in this is that technology faculty are typically in academic units and not service units. Technology faculty can no more be expected to do other peoples Web pages for them than the accounting faculty could be expected to do everybody's taxes. Having the expertise does not mean that you have the time or inclination. If all faculty units would be required to do this as part of their service requirements, then their contracts should be evaluated to make sure that proper consideration is made for this work during tenure, promotion, and merit decisions.

## **Management**

Making full use of the WWW in higher education will improve the university's goodwill or public image. At the time of this writing, any institution that makes it an institutional priority to have every course syllabus online could be seen as a leader in technology. As it becomes more convenient for current and prospective students to locate course information and make better-informed decisions about classes and degree programs the reputation of the university grows. With it grows enrollment, tuition dollars, and funding. But this level may be more difficult to achieve than some think. For example, at one large urban institution that we know of, there are 1,155 undergraduate classes and 1,105 graduate classes listed in the respective catalogs. To put all course syllabi on line, somebody must make sure that all of these syllabi are found, approved, and posted, not to mention updated as needed. This is a daunting task regardless of whether the responsibility is localized within a department or centralized by an outside office. Even though Level 1 is the easiest to achieve from a technical standpoint, it would still require much effort from a planning standpoint.

At Level 1, institutions must make critical and defining decisions about intellectual property and faculty load. Professors often teach classes focusing on their research, so a particular course may rely heavily on a particular person being there to teach it. As more information becomes public an important question must be answered: Who owns the course? Does the university own it because the university employed Professor Smith, or does Professor Smith own it as intellectual property? Putting materials online is not something most people have scheduled time for in their careers. If a faculty member makes the time, should they be compensated for doing this? If it is required of faculty to put course materials on line, should they be given reduced teaching loads? Should they be paid more money? Should a faculty member be paid royalties if the university continues to use the material after the professor leaves? These are critical questions that will need to be addressed.

## **Level 2: Supplemental Web Use**

Supplemental Web use appears to make its greatest impact on actual classroom issues today. These classroom issues in turn impact the educational system in a variety of ways.

## **Teaching**

The most common use of supplemental Web use is putting course notes and handouts on line. At this level the course schedule, which we distinguish here from the syllabus, will go online as well. One advantage of putting the schedule on line is that courses may change with the needs of the students. Course scheduling changes can be made and posted on a weekly basis. This will require more planning on the part of the instructor, and regular access by the students.

Many faculty are taking course handouts, such as Power Point slides, and placing them online as course notes or handouts to be reviewed later. However, a surprise to some people is that once students get the handouts

they stop having a reason to come to class. Rightly or wrongly, lecture notes are often seen as the sole course content. Historically students go to class to get information they will need to pass tests on didactic content. If that didactic content is going to be placed on line, then they may indeed have few reasons to go to class unless the nature of the class changes. So at its most basic point, Supplemental Web use, perhaps more than any, will make the greatest impact on what will happen inside the physical classroom.

As a professor, if I no longer give lectures on a daily basis, what do I do? If the students no longer take notes, what do they do? Obviously this does not sound the death knell for classroom instruction or even the lecture. What it might do is breath new life into the classroom. Good teaching is not merely good public speaking. Good teaching is about providing opportunities for students to become engaged in the learning process (Jonnassen, 1996).

### **Research**

The biggest impact on research at the supplemental level is in dissemination. Researchers can post their preliminary results online and get immediate feedback from their peers. They can access their peers' findings that may affect their own work without having to wait months or even years before seeing them in a journal. Indeed, it is for these sorts of activities that the Web as initially created. (Crossman, 1997) Of course this easy access also removes the safety net of the referring process creating its own set of problems.

In addition, any change in the amount of time faculty spend teaching will have a direct impact on the amount of research and publishing they can do. While certain faculty may be able to use their classes as research settings, clearly all will not. Faculty who make the effort to work on their teaching are rarely rewarded for it (Boyer, 1997). But teaching is a significant type of scholarship, and one that should be treated as such (Boyer, 1997). University tenure committees must begin to recognize this and reward it not only as good teaching, but as good scholarship as well.

### **Service**

If what we know as "traditional" classes change, then we can expect growing pains as this change takes place. If class formats begin to change, then institutions can expect successes at some points, and dismal failures at others. As faculty learn to teach differently, students will need to learn to learn differently. Changes in structure will nearly always be met with resistance initially (Rogers, 1983). At the service component, expect greater time spent in grade appeals. As faculty spend more time working on teaching, expect appeals on tenure decisions. The self-governance function itself may become more open to scrutiny as meeting agendas and minutes are published online. All of this will impact the amount of university service done through self-governance.

### **Management**

In the management component, this level will ultimately be championed if for no other reason than to save printing and copying costs. Freeing up money from departmental photocopying alone may be a tremendous financial boon. However, the administration will need to be tolerant of experimentation. Teaching evaluations may be poor for a period of time as faculty learn to teach differently, and students strive to understand a shift in the focus of the classroom experience. However, the change may bring the university greater recognition and ultimately better faculty, more students, and increased funding.

### **Level 3: Essential Web Use**

As far as teaching and learning goes, putting course information on the Web at level 3 makes two significant assumptions: (1) Faculty and students have appropriate computing and internet access (2) Faculty and students have the requisite skills or support to use the Web. At many universities, these two assumptions are far from being realities.

### **Teaching**

Obviously if the student needs Web access to be a contributing member of the class then the student will need Web skills. The question then becomes where and when does the student get these skills? There have been arguments made that newer students may bring these skills to campus with them. If not, then the university may need to rethink the core curriculum for new students. Freshmen are taught how to write and how to read critically, through "101" courses. Perhaps information technology literacy should also become a "101" course for students

who do not possess these skills. At Level 3, we will very definitely encounter the issues of technology haves and have nots (Trotter, 1996). But students are not the only ones who suffer from poorly developed computer skills. Many faculty do not have adequate equipment in their offices, let alone the skills to produce essential materials.

### **Research**

As with Level 2, teaching should be seen here as a type of scholarship, one that can be measured against particular criteria to ensure that the same rigor that is applied to the teaching process that is applied to the referee process (Boyer, 1997). Faculty may begin to publish research results solely in on-line refereed journals. Promotion and tenure committees may need to be educated as to the value of these sorts of research outlets, and to help them tell the difference between an on-line journal, and simply a paper that has been posted on-line. While I might be able to publish on-line at will, a posted paper is quite different than a published paper.

### **Service**

This level also impacts the service components as well. For with new teaching strategies there will also be new policies and committees. The administration will need to form new committees and new mechanisms for dealing with information from these committees. Existing committees may find more work for themselves as well. Grade appeals are likely to be common for a period of time as faculty and students work towards understanding new strategies. Additionally, the faculty reward structure may need to be revisited. The business of putting education on line is more than simply converting syllabi and handouts to HTML formats. It will involve a comprehensive look at the way that students study and teachers teach. There will be new excuses to deal with (the server ate my homework?) and new ways of meeting with students (such as online office hours). The copy and paste commands, along with copious online term paper sites (i.e., <http://homeworksucks.com>) have made plagiarism much easier. Faculty will need support and release time to do the job well. Students will need time and comprehensive information regarding what the changed expectations are. Finding both support and time may be difficult at many institutions.

In addition, in the professional service element, faculty may spend more time working for their professional organization virtually. Indeed, annual conferences may begin to occur solely online, freeing up time and travel money. However as time increases so does the amount of work required. Faculty may find themselves stretched thinner and thinner as more organizations seek their aid in online endeavors.

### **Management**

Providing for these assumptions will require significant attention from the Management component of the system. At the Management component, this will make its most significant impact in the element of faculty and staff recruitment and Finance. In order to use the Web at level 3, the institution must make a commitment to a faculty and staff that can manage the technology. It is common knowledge that at many institutions there are faculty who are not going to make any changes in the way that they teach. Some institutions are relying on attrition and aggressive faculty training and support to move their institution into a technology using institution. Moreover, the increased burden on the network infrastructure that essential Web use entails may overwhelm some systems. Management will have to work and plan carefully to ensure that university computing resources can meet the demand.

### **Level 4: Communal Web Use**

At the most basic level, Level 4 will need to change the expectations of students and faculty. If classes meet both face to face and on line, then this may impact logistical operations under the management component.

### **Teaching**

Learning to teach online is quite an experience. At this level faculty need not only help in putting information on line, but help in managing the environment as well. Students begin to generate some of the course content themselves requiring faculty to evaluate new content and students to take responsibility for their own learning. This level may require the most fundamental shift in faculties and students mind-sets.

## **Research**

Faculty may begin richer and more frequent collaborations with other researchers at this level of Web use. Distance becomes important only as a function of time of day. Researchers can begin to undertake projects of a scope undreamed of before. Consider for example efforts to crack cryptographic codes that use idle computing time on millions of desktop computers worldwide. Thanks to the Web (and internet) researchers can now do for an insignificant fraction of the cost and time what before would have taken supercomputers working thousands of hours and costing millions of dollars. Massive and convenient collaboration opens the door to more productive research in all fields.

Combining research and teaching becomes possible for a number of faculty. Education faculty may certainly conduct research on the benefits and limits of WBI (Reeves & Reeves, 1997), but other faculty, particularly those in the social sciences, may find research opportunities as well. Special educators may look at the benefits of WBI for students with special needs (Holzberg, 1996). Sociologists may look at the development of online relationships. Information scientists may develop and test new theories and devices, and other scholars can find outlets here as well. The biggest concern here is not that you can do research with your teaching, but rather that within the existing system you get credit for doing the things that advance the mission of the institution. Again we point to Boyer (1997) as having much to say on this subject.

## **Service**

Meetings may now begin to take place entirely online. If nothing else, the onerous task of scheduling meetings will be eased at this level through the use of asynchronous work. Further, records of meetings will be highly detailed and accurate.

## **Management**

The management component of the system can benefit from the use of the WWW at this level. Classes typically scheduled weekly in a room may not need the room every week. Depending on how classes are scheduled, it may be possible to teach two or more classes in the same room on the same night at the same time. This could be a tremendous boon for high use classrooms such as computer labs. Other benefits are just as real if less obvious. Georgia State University is actively encouraging faculty to hold classes online as part of an effort to reduce pollution from traffic in the City of Atlanta.

Communal Web use may also change the way students view schedules and classes. Many students don't feel comfortable with distance education, but they still live too far from campus to drive to every class meeting. Online classes may mean less driving time for students, which in turn means greater convenience for non-traditional students, which in turn provides the university with a reputation of supporting non-traditional students. These can be good things. As fathers of young children, the authors have appreciated the flexibility of conducting classes online from home. It means that at the very least we can be there to say goodnight after a long graduate class. Students also appreciate this flexibility. However most universities have contact hour requirements that state (roughly) that the student and teacher must be in the same room for a set number of hours over the period of the semester. Strict interpretations of existing contact hour requirements will make level 4 use impossible and mean that faculty and students cannot take advantage of this level of Web use.

In addition, as classes begin to move entirely online, the whole issue of what comprises a university begins to change. No longer is a university a place. Far from the Ivory Towers in isolated campuses of yore, universities will be thrust in among all of the other unwashed data on the net. Traditional rivalries and competitors may be replaced with competitors from across the country or around the world. Management will have to carefully consider market segments and demographics in much the same way broadcasting networks do now.

## **Level 5: Immersive Web Use**

This level is steeped in the constructivist paradigm. In it, faculty, staff and students work to assist each other as they approach their respective tasks individually. Socially constructed knowledge exists here, but is secondary to individual constructions.

## **Teaching**

At level five students and teachers interact with each other and directly with the knowledge base. The classroom becomes a true learning community in which knowledge is acquired, created and distributed on an egalitarian basis. The faculty member becomes more of a mentor than an instructor and students and faculty contribute to the literature in a field as well as learn from it. Naturally, this level is best suited to more advanced students and courses.

Though it may seem counter intuitive, the more students a course has, the lower the level of WBI that is appropriate. A fully immersive WBI environment as described in level 5 requires significantly more preparation time and classroom management time for the instructor than a traditional course. In our experience, a large part of this time comes from interacting with individual students. We believe that a single instructor cannot manage more than 10 to 20 students in this type of environment. For every additional 10 to 20 students the instructor should have some sort of teaching assistance. On the other hand, for courses with hundreds of students it makes more sense to distribute as much information as possible on-line. Therefore, for large numbers of students levels 1,2, and 3 are indicated. But levels four and five, in which more interaction is required, should be reserved for smaller classes. This is often times a struggle as you begin to think about implementing Web-based instruction.

### **Research**

Research becomes more integrated with teaching as students as well as faculty begin publishing scholarly work online. Teaching at this level may well follow the conservatory method or that of a hard science research group, whose learning comes in the context of carrying out a research agenda.

### **Service**

Service at this level is conducted entirely online. Virtual meetings and telecommuting are the rule rather than the exception. Virtual "town meetings" may take the place of some committee work where the entire university community participates in discussion of and action on an issue. There is a danger here of grid locked chaos, but the example of the governance of the internet itself suggests that immersive service can work quite well.

### **Management**

The educational system may change strikingly at Level 5. There are organizations, and entire institutions emerging that do nothing but Immersive Web use (The Western Governors University, Nova, The University of Phoenix). In this case, the system itself will evolve around the particular needs and particulars of the university. However, if a traditional university begins to do this type of instruction, then many elements will be impacted. Course evaluations will need to be reconsidered to deal with a student body at a distance. Office hour requirements may need to be rethought to capture the nature of a new kind of student interaction.

This decision will impact the management of the institution significantly. Administrators who are pressed for classroom space and the need to generate more tuition related dollars often encourage faculty to take more students in on-line environments. Administrators need to understand the nature of the environment so that they might help make better policy.

### **Conclusion**

Too often in the history of educational technologies has innovation been carried on in a piecemeal and haphazard fashion. Many creative ideas have been postponed or abandoned altogether, not because they were bad or unworkable, but because they were implemented in ways that at best made success questionable, and at worst guaranteed failure. Web-based education will not go away. It has gained too much momentum; it has reached Rogers' (1983) critical mass. It may founder in higher education for quite some time before it is embraced fully and used effectively as a teaching and learning tool. Or it may, on the other hand, revolutionize the business of higher education. It may enable faculty and students to embrace new methodologies of learning and instruction and make possible rapid, efficient, and effective learning environments of a sort never seen before.

It will probably do both. Some institutions will be incredibly successful at adopting Web-based instruction. Some institutions will be dismal failures. We believe the difference between them will be the manner in which they go about that adoption. Those organizations that undertake the adoption of Web-based instruction in a systematic and systemic fashion stand a good chance of becoming the premier institutions of the next few decades. They will consider the impact of Web-based instruction in all areas. They will acknowledge that Web-based instruction means

different things to different people, that there are levels of WBI. They will probably not move as a whole from one level in our continuum to the next. Instead, different parts of an institution will be at different levels of the continuum at different times. It is likely that some parts of an institution will move down levels rather than up levels. This could occur as they experience disenchantment with the Web or technical frustration. Successful institutions will on average, we believe, continue to move up the continuum toward immersive Web use. Higher education in this country will eventually take place predominantly on the Web. It may take some time, but we academics are not easily discouraged. Instructors who wish to teach otherwise may one day have to do it in secret.

## References

- Banathy, B.H., (1968). *Instructional Systems*. Belmont, CA; Fearon Publishers.
- Boyer, E. L. (1997). *Scholarship reconsidered: Priorities of the professoriate*. The Carnegie Foundation for the Advancement of Teaching. San Francisco, CA. Jossey Bass.
- Crossman, D.M., (1997). The Evolution of the worldwide Web as an emerging instructional technology tool. In B. Khan (Ed.). *Web-based Instruction*. Englewood Cliffs, NJ. Educational Technology Publications pp. 19-24.
- Dick, W. & Carey, L. (1996). *The Systematic Design of Instruction*. Glenview, IL. Scott Foresman and Company.
- Hackbarth, S. (1996). Integrating Web-based learning activities into school curriculums. *Educational Technology* **May/June** pp. 59-66.
- Harmon, S. W.; & Hirumi, A (1996). A Systemic Approach to the Integration of Interactive Distance Learning into Education and Training. *Journal of Education for Business*; v71(5) p267-71.
- Harmon, S. W. & Jones, M. G. (1999). The five levels of web use in education: Factors to consider in planning an online course. *Educational Technology*. November-December, (39) 6, (pp. 28-32).
- Harmon, S. W. & Jones, M. G. (In Press). A Qualitative Analysis of Situated Web-based Instruction *Educational Media International*.
- Holzberg, C. S. (1999). Special ed success stories. In C. Cunningham (Ed.), *Perspectives: Instructional Technology For Teachers*. (pp. 69-72).
- Jonassen, D. H. (1996). *Computers in the classroom: Mindtools for critical thinking*. Englewood Cliffs, NJ: Prentice Hall.
- Jones, M. G. & Harmon, S. W. (In Press). What Professors Need to Know about Technology to Assess Student Learning. In Anderson, R. S., Bauer, J. F., and Speck, B. W. (Eds). *Assessment Strategies for the Online Teacher: From Theory to Practice*.
- Jones, M. G.; Harmon, S. W.; Lowther, D. (2002). Integrating Web-based Learning in an Educational System: A framework for implementation. In Reiser, R. A. & Dempsey, J. V. (Eds), *Trends and Issues in Instructional Design and Technology*. (Pp. 295-306). Upper Saddle River, NF. Pearson Education Inc.
- Khan, B. (1997). Web-based instruction (WBI): What is it and why is it. In B. Khan (Ed), *Web-Based Instruction*. (Pp. 5-18). Educational Technology Publications: Englewood Cliffs, NJ.
- Reeves T. C. & Reeves, P. M. (1997). Effective dimensions of interactive learning on the world wide Web. In B. Khan (Ed), *Web-Based Instruction*. (Pp. 59-66). Educational Technology Publications: Englewood Cliffs, NJ.
- Rogers, E.M., (1983). *Diffusion of innovations*. 3d ed. New York: Free Press.
- Trotter, A. (1999). The great divide: Closing the gap between technology haves and have-nots. In C. Cunningham (Ed.), *Perspectives: Instructional Technology For Teachers*. (pp. 64-68).
- von Bertalanffy, Ludwig; (1968) *General Systems Theory*, George Braziller, New York



## WEB-Folio: INTASC Principles to Danielson's Framework

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### ABSTRACT

*Based upon the need for assessment of teachers, both pre-service and in-service we are in the processes of modifying all education courses to include reference to and use of Danielson Framework linked to current structure, which used INTASC Principles. Adaptation of our standards for assessment to better address the assessment parameters of Danielson's Framework is being done through a visual presentation. By using Inspiration to design the flow chart, and construction of a WEB-Folio template we are better able to show how it may serve as the assessment tool. Our timeline began with inclusion of INTASC Principles during our NCATE review and has continued to be a primary tool for student teacher observation. As we adapt to the use of the Framework, in preparation for utilization in Fall 2001, courses are being modified, students being acquainted with the domains, and a phase in plan being developed that allows for adjustment and absorption by both faculty and students. This presentation will deal with our adaptation, the basic frameworks domains, and how we designed the final Web-Folio to work for us in this assessment.*

### Background of the Study

Throughout the United States today, many teacher education programs and school systems are addressing the growing need of ways for assessing pre-service teachers academic performance. Many colleges have adopted some form of statewide and or national educational standards for assessment. The Commission, National Commission on Teaching and America's Future (NCTAF) prefers to use the word *assessment* because the word *test* evokes an image of simple paper-and-pencil examinations. The word assessment encompasses paper-and-pencil tests, portfolios containing examples of work, videotapes, and observations." (Spring, 29-30) For the past six years, Columbus State University has utilized many forms of assessment models to measure academic performance, teaching practice and the teaching knowledge of pre-service teachers. These assessment models include: (1) Interstate New Teacher Assessment and Support Consortium (INTASC) and (2) the Educational Testing Service's PRAXIS I & II exams. Following this a framework was "developed by Charlotte Danielson, who worked at the Educational Testing Service on both the PRAXIS III and national board standards and assessments. Her framework comprises 22 different teaching components organized into four teaching domains, and thus provides a rich, comprehensive description of good teaching practice. In addition, the ETS has developed a set of instruments that districts can use to assess an individual teacher's practice to four different levels of performance."

<http://www.edweek.org/ew/1999/41odden.h18>

One of the earlier efforts was the production of a template utilizing Digital Chisel because of its availability in both Macintosh and PC formats. With the introduction of HyperStudio for PC, the template was redesigned for that software. Students were instructed in the use of the technology to modify these templates. The equally acquired documentation of skills and knowledge gained in the program as they met the INTASC Principles and state standards. As a continued effort in this process, the College of Education at Columbus State University conducted some research to identify the most valid, reliable and salient research findings on assessment models for measuring student's academic performance. Realizing that tangible products representing the student work would be an asset in evaluating the mastery of professional skills in teaching, the use of portfolios was investigated and determined to be one means of better incorporating examples into the process.

The term portfolio was not new, and certainly is a common form of assessment. The major distinction would be the nature of the portfolio. As part of this ongoing assessment development, research was conducted on the differences and similarities of paper, electronic, and web-based. From a basic understanding, it became quite evident that the advantage of not having to carry boxes of print materials, store disks, and maintain files, that web-based is the most attractive alternative. This research will be implemented in both revised pre-service and in-service program.

We are told, "Assessment is education's new apple pie issue. Everyone supports efforts to improve education; and everyone seems to believe more assessment will help improve education. Green & Smyser (1996) believe that "it's just grand that many people in so many elected and administrative offices support assessment." They went further to discuss the complexity of assessment. They emphasized that "there is, however, one little

problem: getting all these individuals to agree on *how* and *what* to assess and *how to use the data*. They all agree about the *need* for more assessment, Unfortunately, the devil is in the details." (Green, K. p 62)

### **Implementation process of MAP at Columbus State University**

The structure of the ten INTASC Principles served as a well-rounded guide to the development of professional educators, but did not provide distinctive components upon which to assess mastery of the skills of teaching. Thus, another barrage of search was undertaken to identify a tool to link our existing evaluation of INTASC Principles to deeper, more easily measurable elements of the pedagogical process. As a result of the research findings a group of faculty members were sent to Vermont to attend a workshop on Danielson Framework. These colleagues became known as the "Vermont Five". Following the guidelines in the framework, they stressed the "view of the characteristics that underlie all effective teaching is the "Framework for Teaching," developed as part of the Praxis Series: Professional Assessments for Beginning Teachers. According to the Praxis framework, a teacher must be proficient in four domains: planning and preparation, structuring classroom environment, instruction, and professional responsibilities." (Parkay, 357) Four months later, all faculty members in the Department of Curriculum Education and student teachers/field experience supervisors attended a two-day workshop on Danielson's Framework. The Educator Preparation Faculty also in 2000-2001 made some adaptations to Danielson's Framework to reflect Columbus State University, College of Education (COE) Conceptual Framework. The adaptation, under the leadership of Dr. Virginia Causey, was dubbed the Model of Appropriate Practice (MAP). Thus the MAP puts into practice the principles of the COE Conceptual Framework.

### **Orientation of faculty to Danielson Framework**

Following the adaptation of the Framework to become the Columbus State University, College of Education Model of Appropriate Practice (MAP), an orientation was planned. This consisted of an overview, two-day workshop, and evaluation workshop for use of appropriate software. The software, Pathwise, provided a method to help evaluate student teachers and teachers in the field "within these domains while taking into account individual, developmental, and cultural differences among students and differences among subjects." (Parkay, 357) Then MAP was addressed again as part of the back to school Teacher Planning Week in August 2001. The faculty also recommended that the MAP should be infused in all pre-service teacher education courses starting with EDUF 2215 – Introduction of Education - The American Educational Experience. As MAP began its implementation, faculty members were assigned the task to develop an understanding of Danielson's Framework, its relationship to INTASC, and a way that these might be evaluated within a web based tool for assessment.

### **Development of instructional model and student model**

The need to provide a presentation, for the purpose of instruction in the WEB-Folio, was indicated by the faculty members. The decision to use PowerPoint for initial presentation and conversion to html (web-based materials) was made based upon (1) availability, (2) familiarity to students (3) adaptability. We did research on available software according to cost, mastery of skills, and general availability. Having used Digital Chisel, HyperStudio, PowerPoint, Macromedia, Astound, it was our decision that the best, most time and cost efficient approach would be to keep it simple (KISS). This way, as our students' access and skills improved, it would be easy to upgrade the folios, and of course, any student will be free to use WEB-CT, FrontPage, etc. as they so choose. We only require that they (1) provide us access, and (2) address the Domain elements as proposed in the Guide and MAP publications. Once the template design had been developed, it was easy to see that taking the student template and filling in the blanks was the easiest method of providing for instructional needs. As the utilization of standards is a good way to provide a framework for education, they contribute to ensuring accountability and verifiable results. Students could have a professor elaborate on each Domain, the specific expectations for collection of "artifacts" and methods of inclusion, and retain a copy for use as a guide that supported the rubric provided for grading. The blank template, which included a frame for each Domain and for each subheading was designed. Upon completion it is to be mounted to a web site for downloading, copied to disks, and revision. The requested data to be included set the level for the standard to be met. Thus, we set our "High and clearly articulated standards for what children should know and learn (to) help teachers to become better educators and help students become better learners." (Paige, 8).

## **Presentation to faculty**

"...teachers must be involved. The history of efforts to bring innovations into education documents the critical role of teacher involvement at each step along the way. If the assessment movement is to be successful, it must convince teachers that the intent of assessment is to provide feedback to the student, to parents, and to teachers about student learning. Assessment will fail if it becomes a punitive measure against teachers." (Green, K. p. 63) During workshops held as part of the orientation to the College of Education Model of Appropriate Practices (MAP), it was announced that Drs. Kuforiji and Riggsby had been given the assignment to develop a WEB-Folio for use in assessment of our students. As fall semester began, the Teacher Planning Week activities included a slot for us to share the process and template we had developed during four months of work. At this time, a sample PowerPoint presentation was shared that provides the faculty member with a means to show the students what is expected with samples for each area of the Domains, and a template, which provides the student with a master for inclusion of work samples. These were uploaded to a Website and a password given to them so that they might have access to updates, new materials, and other things we would like to share about this product.

## **Orientation in class**

Presentation of the model initially takes place during EDUF 2215: The American Educational Experience orientation session. This session the students are given an overview of the nature of the assessment, based on samples of work (artifacts), and the tool for exhibiting these (WEB-Folio). There is a demonstration of the PowerPoint template, which has the frames filled in with sample ideas of what to include. The specific areas that are to be completed at the end of this class are stressed. In EDUF 2215, the student must complete a basic resume, with a frame for each of the areas, such as Personal Information, Education, Work History, Professional Activities, Community Service, Honors, and References; and fifty percent of Domain 1, which deals with Planning and Preparation for Teaching. A WEB-Folio Guide has been prepared to present this information in printed format. This guide is available on the class web site for download.

## **Semester of field-testing**

Currently (Fall semester 2001) we are engaged in the initial test of our template and instructions. The template, at this point, is one in PowerPoint. This was selected as a commonly recognized format that would be less threatening as an initial format, as well as one that is easily converted to html. Sophistication will follow as the students take advantage of the program to study higher technology skills. At this stage, we are more concerned with ability to understand the nature of the assessment program, what one is trying to assess, and how to identify representative "artifacts" to select for inclusion. The *Guide to the WEB-Folio* is presented to the students in teacher preparation, but we find that comprehension of the written word may be a challenge. A rubric developed for grading the product, the time line for development, and sample ideas for inclusion are also provided for faculty and student guidance. Basically, the very nature of this being a NEW idea to students makes it appear to be a difficult assignment. We are finding that five minutes of direct question and answer sends the student off satisfied with the knowledge of what is expected.

## **Identification of Domains for each course in Education**

Each professor, whether full-time or part time is encouraged to identify the parts of the Domains that are applicable to the course being taught. Hopefully, program coordinators will help all those individuals teaching a specific course to come to an agreement of the common elements from the Framework (MAP). The development of a form for determining the elements of each of the four domains was presented to all professors within the College of Education for each course being taught. Upon completion of these, the report will be correlated for each major in order to provide a flow chart enabling the student to know what is expected for each course as part of the WEB-Folio. Upon establishment of the template on the Web, students and faculty may freely begin constructing a personalized format of the assessment tool. Each faculty member will be aware of the point in time when the class must include specified elements of the Four Domains of CSU MAP. The students will have gradually become comfortable with updating entries and adding new frames for their ever-expanding catalog of "artifacts" to support the criteria for evaluation. The Faculty will be prepared to check the elements relative to the specific course and notations of needs for inclusion or improvement before permitting the student to continue in the program. As the

process is perfected, files will be maintained and student assessment becomes an incremental task shared by all faculty members in the program.

#### References:

- Barrett, Helen (2000). "Create your own electronic portfolio." *Learning & Leading with Technology* (April, 2000)
- Barrett, Helen (1998). "Strategic questions." *Learning & Leading with Technology* (October, 1998)
- Boulware, Bratina, Holt & Johnson (1997). *Developing professional teaching portfolios using CD-ROM technology as a teaching-learning tool. SITE, 1997.* <http://www.unf.edu/~tbratina/cdrom.htm>
- Campbell, Cignetti, Melnyzer, Nettles & Wyman (1997). **How to develop a professional portfolio: A manual for teachers.** California University of Pennsylvania.
- Costantino, Patricia and Lorenzo, Marie. (2002). **Developing a professional teaching portfolio: A guide for success.** Allyn and Bacon. Boston. 2002
- Danielson, C. (1996). **Enhancing professional practice: A framework for teaching.** Alexandria, VA: Association for Supervision and Curriculum Development.
- Darling-Hammond, Ed. Sykes, Linda and Gary. (1999). **Teaching as the learning profession — Handbook of policy and practice.** San Francisco, CA: Jossey-Bass. 1999.
- Diez, Ed. (1998). **Changing the practice of teacher education — Standards and assessment as a lever for change.** Washington, DC: American Association of Colleges for Teacher Education. 1998.
- Glatthorn, Allan A., Bragaw, Don; Dawkins, Karen; and Parker, John. (1998) **Performance assessment and standards-based curricula: The achievement cycle.** Larchmont, NY: Eye on Education.
- Green, James E. and Smyser, Sheryl O. (1996). **The teacher portfolio — A strategy for professional development and evaluation.** Lancaster, PA: Technomic Publishing Company, Inc. 1996.
- Green, Kenneth C. "Thinking About Assessment." **Converge.** Vol. 4; Issue 8. August 2001. Pp. 62-63
- Jacobs, Heidi. (1997). **Mapping the big picture- integrating curriculum & assessment k-12.** Alexandria, VA: Association for Supervision and Curriculum Development. 1997
- Kearney, Karen and Roberts, Laraine (1995). **Designing performance-based assessment for powerful student learning.** Alexandria, VA: Association For Supervision and Curriculum Development.
- Martin-Kniep, Giselle (1998). *Why am I doing this? Purposeful teaching through portfolio assessment.* Portsmouth: Heinemann
- Marzano, Robert J., Pickering, Debra; and McTighe, Jay. (1993). **Assessing student outcomes — performance assessment using the dimensions of learning model.** Alexandria, VA: Association for Supervision and Curriculum Development.
- Martin, Debra B. **The portfolio planner: Making professional portfolios work for you.** Merrill, Columbus, Ohio. 1999.
- Paige, Roderick (2001) "A roadmap to academic progress." **Teaching k8.** August/September 2001. p. 8
- Parkay, Forrest and Stanford, Beverly. (2001) **Becoming a teacher.** Allyn and Bacon. Needham Heights, MA. Pp. 356-359. 2001.
- Seldin, Peter (1997). **The teaching portfolio.** Bolton: Anker Publishing
- Spring, Joel. (2002) **American education.** McGraw Hill, Boston.
- Wolf, Kenneth (1999). **Leading the professional portfolio process for change.** Arlington Heights, IL: Skyline Professional Development

#### Links to Danielson

<http://www.ascd.org/readingroom/books/196074.html>

**Association for Supervision and Curriculum Development**

<http://www.ascd.org/readingroom/books/danielson96book.html#chap1>

**Association for Supervision and Curriculum Development – sample**

<http://www.emu.edu/educ/mission.html>

**Eastern Mennonite University, Harrisonburg, VA**

<http://www.emu.edu/educ/mission.html#chart>

**Links for INTASC, Praxis III, and Danielson Framework**

<http://www.valdosta.edu/~alhines/>

**Sample of student portfolio.**

<http://www.wcer.wisc.edu/cpre/tcomp/research/standards/framework/>

**Framework for teaching project**

[http://www.mpls.k12.mn.us/staff/teacherportfolio/portfolio\\_Homepage1.html](http://www.mpls.k12.mn.us/staff/teacherportfolio/portfolio_Homepage1.html)

**Minneapolis New Teacher Portfolio site**

<http://www.ets.org/aboutets/news/00111502.html>

**Educational Testing Service news site**

<http://www.state.tn.us/education/frameval/index.html>

**Link to Tennessee assessment site**

#### Search engines

[http://www.comsearch.net/search\\_engine\\_directory.htm](http://www.comsearch.net/search_engine_directory.htm)

# Instructional Systems & Distance Education: Understanding the Implications

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## Abstract

*The design of instructional text is an important consideration when attempting to design a successful learning environment. With the rising involvement in online distance education, it is becoming even more important to adhere to good principles of text design. The purpose of this paper is to provide a framework of possible instructional systems design strategies and their associated tactics to use in an online environment based on research studies conducted on traditional paper-based materials. We argue that the focus on content, and particularly the focus on designing quality content should not be discouraged, but rather, we must consider it as a fundamental foundation for the development of other online components. The intellectual property of the faculty member, the content, the “text” as it is called in its fundamental sense should serve as the basis by which we ground our communication, our understanding, and our interactions in an online distance education course.*

## Introduction

The design of instructional text plays an important role in the field of Instructional Systems. It is through text which we receive many of our day-to-day messages, including simple things such as menus and memos, to more complex texts such as textbooks and articles. The increasing number of distance education courses is creating a new text medium through which individuals can interact. Many of the information learner’s process come through the medium of text. In order for text to be in existence, authors must put forth their words of communication into a form, such as a book, article, memo, and now on-line courses, and the learner must interact with it. It may appear simple but much is going on between the time the author puts their content on paper and the learner attends to it, interacts with it, and processes it. What is occurring relates to a learner’s text processing strategies (Duchastel, 1982). The text should not merely be a message from the author, but rather the message should be encompassed in a textual design which promotes learning.

Duchastel (1982) identifies the processes of attention, comprehension, and retention as crucial to the textual processing of a message. The learner must first be able to pay attention to a piece of text and sustain interest. The learner must then be able to understand what the author is trying to convey, and for ultimate effectiveness in the communication of a message, the learner will retain what they have learned. If we agree that these processes are vital to the communication of a textual message, then we can begin to speculate about strategies and tactics that authors can utilize to enhance the likelihood that each of the above processes would occur.

Where the conundrum occurs is in the medium of on-line distance education courses. There has been an abundance of research studies addressing text design variables in more traditional paper-based materials, but few studies have investigated the use of design strategies and tactics in an on-line distance education environment. In fact, some researchers argue that the capacity for the new technology to enhance learning quality is failing on-line courses (Duchastel, 1997). The only analyses of online courses have produced results indicating authors are simply creating electronic versions of their traditional print-based materials (Dehoney & Reeves, 1998). This paper provides an alternative way of viewing this discouraging environment of course quality and use of design strategies. We argue that creating an on-line course must begin with a fundamental examination of the “text”. Regardless of the type of interaction strategies, communication environments, or activities planned in an on-line course, the content (which can be referred to as the text or the intellectual property of the faculty member who authored it) provides the essential foundation from which the interaction, communication, and collaboration activities can occur. The purpose of this paper is to provide a framework of possible instructional systems design strategies and their associated tactics based on research studies conducted on traditional paper-based materials. It is not the purpose to provide an exhaustive review of all possible design tactics that can be utilized in an on-line environment, but rather to stimulate interest in formulating basic research in the design of content in on-line environments.

In order to elicit optimal text processing as discussed by Duchastel (1982) above, he has grouped the various design tactics into three broad strategies: labeling, highlighting, and illustrating. Labeling strategies identify and summarize the facts, concepts, rules, principles, and procedures in the text. Highlighting strategies help the learner to focus on the material. The third strategy, illustrating, assist the learner with the functions of attention, comprehension, and retention. Each of these strategies and their associated tactics can help the author structure and organize content in such a way as to promote the acquisition, integration, comprehension, and application of the message being communicated. The next section will provide a sampling of possible tactics that can be utilized under each of the strategies identified by Duchastel (1982).

## **Instructional Strategies**

This section will describe the three instructional strategies of labeling, highlighting, and illustrating. Within each of these strategies, specific tactics that would be most easily implemented in an on-line distance education medium will be identified. Although research in the area of instructional systems has primarily focused on the design of text-based materials, the increasing rise of on-line distance education courses provides an impetus for identifying which text-based variables could serve to enhance the quality of on-line materials. Once particular variables have been identified, research studies need to be conducted to determine the effectiveness and efficiency of these text-based variables in an on-line medium.

### **Labeling**

The major design variables that can be utilized under the general category of labeling include headings, marginal notes, and embedded glossaries. The purpose of these tactics is to identify and summarize the content provided by the author. The content can be in the form of facts, concepts, rules, principles, and/or procedures. These tactics can serve to enhance learner attention, comprehension, and retention of the material at the lowest level of processing. These instructional tactics also tend to be fairly efficient. Labeling is often associated with the strategy of signaling which is defined as orienting the learner to the text through the use of various textual display tactics. The purpose of signaling/labeling is to help the learner identify the “structure, type, or function of content” (Jonassen & Kirschner, 1982, p. 124). Its purpose is to orient the learner to the text document and allow them to organize their attention and retrieval strategies to improve performance. In the following paragraphs, the use of headings, marginal notes, and embedded glossaries will be discussed.

Headings can be defined as a typographically and spatially distinct piece of text signifying the theme or content of the section following it. Headings have been shown to increase the general improvement of text memory (Lorch & Lorch, 1985). Even when a variety of different measures are used, such as cued recall summarization, or free recall, headings show improvement for memory (Dee-Lucas & DiVesta, 1980; Hartley & Trueman, 1985; Holley, Dansereau, Evans, Collins, Brooks, & Larson, 1981). Headings are a relatively efficient way to incorporate good instructional design in on-line courses.

The second labeling tactic, marginal notes, has received little research attention. Marginal notes are defined as a column alongside the content which both outlines the content and acts as a running summary. Duchastel and Chen (1980) also find marginal notes act as an “access structure” allowing the learner to identify the appropriate details from the overall text. Although they did not conduct an experimental student regarding marginal notes, Duchastel and Chen (1980) surveyed sixteen students and found that fifteen of them agreed that marginal notes were useful. Marginal notes, if used appropriately, can be an excellent addition to an on-line course. The only dilemma to is the necessity to avoid the use of frames in creating the marginal note column. Web sites using frames create extreme difficulties for individuals with disabilities who use screen readers.

The third labeling tactic is the use of an embedded glossary. Acting as a terminology marker, an embedded glossary is defined in this project as a tool which identifies difficult words and defines them. This tactic is fundamentally different from marginal notes, though, because it does not attempt to summarize any of the information learned up to a given point. It merely identifies a present word on the page and defines it so the learner is less involved in the terminology and more involved with the content. Although research has not investigated the effectiveness of embedded glossaries, the use of an embedded glossary is a relatively easy tactic to implement in an on-line course. The author of the course can simply identify difficult words in the text and hyperlink them to a page containing the definition.

Table 1 provides a brief overview of each of these tactics and additional ones, their purposes, and research literature that has examined them.

Table 1. Labeling Strategy Tactics

Tactic	Purpose	Research Literature
<b>Headings</b>	<ul style="list-style-type: none"> <li>▪ Identify main points</li> <li>▪ Enhance organization</li> <li>▪ Increase retrieval</li> <li>▪ Provide structure</li> </ul>	<ul style="list-style-type: none"> <li>▪ Doctorow, Wittrock, &amp; Marks, 1978</li> <li>▪ Dee-Lucas &amp; DiVesta, 1980</li> <li>▪ Hartley, Kenely, Owen, &amp; Trueman, 1980</li> <li>▪ Holley, Dansereau, Evans, Collins, Brooks, &amp; Larson, 1981</li> <li>▪ Lorch &amp; Lorch, 1985, 1996</li> <li>▪ <i>Hartley &amp; Trueman, 1985</i></li> <li>▪ <i>Wilhite, 1989</i></li> </ul>
<b>Marginal Notes</b>	<ul style="list-style-type: none"> <li>▪ Identify and summarize main points</li> <li>▪ Focus attention</li> <li>▪ Increase retrieval and provide structure</li> </ul>	<ul style="list-style-type: none"> <li>▪ Duchastel &amp; Chen, 1980</li> </ul>
<b>Embedded Glossary</b>	<ul style="list-style-type: none"> <li>▪ Identify and define key concepts</li> <li>▪ Clarify text and enhance retrieval</li> </ul>	<ul style="list-style-type: none"> <li>▪ No literature found specifically addressing embedded glossaries</li> </ul>
<b>Chunking/ Spacing Text</b>	<ul style="list-style-type: none"> <li>▪ Enhance structure and organization</li> <li>▪ Assists with organization and retrieval</li> </ul>	<ul style="list-style-type: none"> <li>▪ Miller, 1956</li> <li>▪ Frase &amp; Schwartz, 1979</li> <li>▪ Wilson, Pfister, &amp; Fleury, 1981</li> </ul>

### Highlighting

The major design tactics that can be utilized under the instructional strategy of highlighting include typographical cues, objectives, summaries, questions and advanced organizers. The purpose of these techniques is to highlight for the learner important content. These techniques can also organize the content for the reader, which will enhance their attention, comprehension, and retention of the content at a deeper level of processing than is provided by the labeling instructional strategy. Highlighting is related to the strategy of controlling defined as the utilization of textual display tactics to initiate different mental processing capabilities. The purpose is not only to signal the text but also to control the attention of the learner, and purposefully identify information that is important and requires the learner's focus. In the following paragraphs, the use of typographical cues, advanced organizers, and objectives will be discussed.

Typographical cues are a very cost-efficient method of improving the structure of a text document. Particularly with the use of bolding or italicizing, one can increase the readability of the text and increase the likelihood that the learner will extract the main points. Typographical cues are defined as a highlighted text word or fragment in the body of the text which serves to draw a learner's attention to the content surrounding it. Typographical cues have been studied extensively, and many studies have found the use of them to improve memory for the text word or fragment it is highlighting (Cashen & Leicht, 1970; Glynn & Divesta, 1979). One unresolved matter in experimental studies on typographical cues is the effect on the content which is not highlighted. Some have found that memory for text which was not highlighted to be unaffected (Foster, 1979) while others found it to inhibit recall (Glynn & Divesta, 1979). The importance of distinguishing among facts, concepts, and rules/principles may play a role in this particular contradiction. A possible explanation is typographical cues may need to be used on specific types of information. For example, they may be more appropriate to use on facts. Further research can help to clarify inconsistent results. Although bolding, italicizing, underlining, all caps, and color can be used to create typographical cues, the most cost efficient in developing an on-line course would be the use of bolding or italicizing. Underlining and words in color can often be confused with hyperlinked items.

The second major highlighting tactic to be discussed here is the use of advanced organizers. Advanced organizers are defined as a brief verbal statement providing a mechanism for the learner encoding process. This brief verbal statement contains no reference to the content in the document, but rather sets up the organizational features of the document to aid the learner's processing. As seen with some of the other mentioned text variables above, advance organizers have conflicting findings. Ausubel (1960), the pioneer of advance organizers, found in all of his studies that those groups with advanced organizers recalled more than that of the control group. Hartley and Davies (1976) after summarizing the results of many studies on advanced organizers found that the use of them does improve learning. Particularly for an on-line course where the learner is at a distance from the instructor, it is important to provide a clear understanding for the learner regarding the types of strategies and tactics utilized throughout the document. For example, if the author of a course decides to utilize typographical cues to symbolize important concepts by bolding them, the student should be made aware that bolded words symbolize concepts they



need to make sure they understand. Advance organizers may even be useful for stimulating motivation because they serve to increase confidence (Keller, 1987) in what the learner is likely to expect within the content.

Objectives are defined as statements of what the learner should know and be able to answer questions about in the upcoming sections. Objectives are another area of contradictory study. Some experimental studies have found that learning is improved by the use of objectives (Rothkopf & Kaplan, 1972), while other studies have found the opposite finding (Jenkins & Deno, 1971). One possible explanation for the inconsistency in research results could be that the objectives in each study may have been written using incomparable models. Most instructional designers use Mager's (1975) model for writing behavioral objectives. This model stipulates that objectives should include the actual skill or behavior that the learner should be able to perform upon completion of the instruction, conditions under which the learning should occur, and the criteria for successful performance. The use of objectives is a cost efficient and if used appropriate, effective strategy to utilize in an on-line course.

Table 2 provides a brief overview of each of these tactics and additional ones, their purposes, and research literature that has examined them.

*Table 2. Highlighting Strategy Tactics*

<b>Tactic</b>	<b>Purpose</b>	<b>Research Literature</b>
<b>Typographic Cues</b>	<ul style="list-style-type: none"> <li>▪ Focus attention on material</li> <li>▪ Facilitate learning and retrieval of main points</li> <li>▪ Enhance structure and organization</li> </ul>	<ul style="list-style-type: none"> <li>▪ Cashen &amp; Leicht, 1970</li> <li>▪ Fowler &amp; Baker, 1974</li> <li>▪ Glynn &amp; Divesta, 1979</li> <li>▪ Foster, 1979</li> <li>▪ Hartley, Kenely, Owen, &amp; Trueman, 1980</li> <li>▪ Nist &amp; Hoglebe, 1987</li> </ul>
<b>Advanced Organizers</b>	<ul style="list-style-type: none"> <li>▪ Focus attention on document</li> <li>▪ Facilitate learning and retrieval of main points</li> <li>▪ Enhance structure and organization</li> <li>▪ Provide learner a content-oriented summary to help learner focus on important points as they read through document</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ausubel, 1960, 1962, 1963, 1968, 1978</li> <li>▪ Ausubel &amp; Fitzgerald, 1961, 1962</li> <li>▪ Barnes &amp; Clawson, 1975</li> <li>▪ Hartley &amp; Davies, 1976</li> <li>▪ Luiten, Ames, &amp; Ackerson, 1976</li> <li>▪ Mayer, 1979</li> <li>▪ Hartley &amp; Trueman, 1982</li> <li>▪ Lorch &amp; Lorch, 1985, 1996</li> </ul>
<b>Objectives</b>	<ul style="list-style-type: none"> <li>▪ Focus attention on material</li> <li>▪ Facilitate learning and retrieval of main points</li> <li>▪ Enhance structure and organization</li> </ul>	<ul style="list-style-type: none"> <li>▪ Rothkopf &amp; Kaplan, 1972</li> <li>▪ Duchastel &amp; Merrill, 1973</li> <li>▪ Duell, 1974</li> <li>▪ Hartley &amp; Davies, 1976</li> <li>▪ Davies, 1976</li> <li>▪ Duchastel, 1979</li> </ul>
<b>Summaries</b>	<ul style="list-style-type: none"> <li>▪ Enhance focus/comprehension of material</li> </ul>	<ul style="list-style-type: none"> <li>▪ Newsom &amp; Gaitte, 1971</li> <li>▪ Hartley &amp; Burnhill, 1978</li> <li>▪ Hartley, Goldie, &amp; Steen, 1979</li> <li>▪ Reder &amp; Anderson, 1980</li> </ul>
<b>Questions</b>	<ul style="list-style-type: none"> <li>▪ Enhance deeper level of processing</li> </ul>	<ul style="list-style-type: none"> <li>▪ Rickards &amp; Denner, 1978</li> </ul>

### **Illustrating**

The strategy of illustrating tends to incorporate the least cost-efficient tactics. Tactics such as graphics and diagrams tend to cost additional money to develop but can increase the level of processing of particular content. Table 3 provides a brief overview of the tactics of graphics and diagrams/flowcharts/tables, their purposes, as well as research literature that has examined them.

*Table 3. Illustrating Strategy Tactics*

<b>Tactic</b>	<b>Purpose</b>	<b>Research Literature</b>
Graphics	<ul style="list-style-type: none"> <li>▪ Provide additional assistance in</li> </ul>	<ul style="list-style-type: none"> <li>▪ Dwyer, 1968, 1972</li> </ul>

	<ul style="list-style-type: none"> <li>▪ processing content</li> <li>▪ Offer a visualization of textual description</li> </ul>	<ul style="list-style-type: none"> <li>▪ Hurt, 1987</li> <li>▪ Levie, 1987</li> <li>▪ Weidenmann, 1989</li> </ul>
Diagrams/ Flowcharts/ Tables	<ul style="list-style-type: none"> <li>▪ Offer a hierarchical or process orientation for content through visual representation</li> </ul>	<ul style="list-style-type: none"> <li>▪ Burnhill, Hartley, &amp; Young, 1976</li> <li>▪ Richards &amp; Johnson, 1980</li> <li>▪ Larkin &amp; Simon, 1987</li> </ul>

## Conclusion

The framework of strategies and tactics provided offers a chance to reassess the way we view content in the online environment. Some authors believe that current and forward thinking should encourage a discouragement of the emphasis on content in the design process (Oliver, 1999) in favor of a focus on learning activities and learning supports. We argue that the focus on content, and particularly the focus on designing quality content should not be discouraged, but rather, we must consider it as a fundamental foundation for the development of other online components. The intellectual property of the faculty member, the content, the “text” as it is called in its fundamental sense should serve as the basis by which we ground our communication, our understanding, and our interactions in an online distance education course.

## References

1. Ausubel, D.P. (1960). The use of advance organizers in the learning and retention of meaningful and verbal material. *Journal of Educational Psychology*, Vol. 51, 267-272.
2. Ausubel, D.P. (1962). A subsumption theory of meaningful verbal learning and retention. *Journal of General Psychology*, Vol. 66, 213-224.
3. Ausubel, D.P. (1963). *The psychology of meaningful verbal learning*. New York: Grune & Stratton, 1963.
4. Ausubel, D.P. (1968). *Educational psychology: A cognitive view*. New York: Holt, Rinehart, & Winston.
5. Ausubel, D.P. (1978). In defense of advance organizers: A reply to the critics. *Review of Educational Research*, Vol. 48, 251-257
6. Ausubel, D.P., & Fitzgerald, D. (1961). The role of discriminability in meaningful verbal learning and retention. *Journal of Educational Psychology*, Vol. 52, 266-274.
7. Ausubel, D.P., & Fitzgerald, D. (1962). Organizer general background, and antecedent learning variables in sequential verbal learning. *Journal of Educational Psychology*, Vol. 53, 243-249.
8. Barnes, B.R., & Clawson, E.U. (1975). Do advance organizers facilitate learning? Recommendations for further research based on an analysis of 32 studies. *Review of Educational Research*, Vol. 45(4), 637-659.
9. Burnhill, P., Hartley, J., & Young, M. (1976). Tables in text. *Applied Ergonomics*, 7, 13-18.
10. Cashen, V.M. & Leicht, K.L. (1970). Role of the isolation effect in a forma educational setting. *Journal of Educational Psychology*, 61, 484-486.
11. Davies, I.K. (1976). *Objectives in curriculum design*. New York: McGraw-Hill.
12. Dee-Lucas, D. & DiVesta, F.J. (1980). Learner-generated organizational aids: Effects on learning from text. *Journal of Educational Psychology*, Vol. 72, 304-311.
13. Dehoney, J. & Reeves, T. (1998). Instructional and social dimensions of class web pages. *Journal of Computing in Higher Education*, 10(2), 19-41.
14. Doctorow, M., Wittrock, M.C., & Marks, C. (1978). Generative processes in reading comprehension. *Journal of Educational Psychology*, Vol. 70, 109-118.
15. Duchastel, P. (1979). Learning objectives and the organization of prose. *Journal of Educational Psychology*, Vol. 71(1), 100-106.
16. Duchastel, P. (1982). Textual display techniques. In Jonassen, D.H. (1982). *The Technology of Text: Principles for Structuring, Designing, and Displaying Text*. Educational Technology Publications. Englewood Cliffs: NJ.
17. Duchastel, P. (1997). A web-based model for university instruction. *Journal of Educational Technology Systems*, 25(3), 221-228.
18. Duchastel, P. & Chen, Y. (1980, November). The use of marginal notes in text to assist learning. *Educational Technology*, Vol. 20(11), 41-45.
19. Duchastel, P., & Merrill, P. (1973). The effects of behavioral objectives on learning: A review of empirical studies. *Review of Educational Research*, vol. 43, 53-69.

20. Duell, O.K. (1974). Effect of type of objective, level of test questions, and the judged importance of tested materials upon posttest performance. *Journal of Educational Psychology*, Vol. 66(2), 225-232.
21. Dwyer, F.M. (1972). *A guide for improving visualized instruction*. State College, PA: Learning Services.
22. Dwyer, F.M. Jr. (1968). The effectiveness of selected visual illustrations in teaching science concepts to college freshman. *The Journal of Educational Research*, Vol. 61, 343-347.
23. Foster, J.J. (1979). The use of visual cues in text. In P.A. Kolers, M.E. Wrolstad, and H. Bouma (Eds), *Processing of Visible Language*, Vol 1, 189-203. New York: Plenum Press.
24. Fowler, R.L., & Baker, A.S. (1974). Effectiveness of highlighting for retention of text material. *Journal of Applied Psychology*, Vol. 59, 358-364.
25. Frase, L.T. & Schwartz, B.J. (1979). Typographical cues that facilitate comprehension. *Journal of Educational Psychology*, Vol. 71, 197-206.
26. Glynn, S.M. & DiVesta, F.J. (1979). Control of prose processing via instructional and typographical cues. *Journal of Educational Psychology*, Vol. 71, 595-603.
27. Hartley, J. & Burnhill, P. (1978). Fifty guidelines for improving instructional text. In J. Hartley and I.K. Davies (Eds) *Contributions to an Educational Technology*, Vol. 2 London: Kogan Page/New York: Nichols, 1978.
28. Hartley, J. & Davies, I.K. (1976). Pre-instructional strategies: The role of pretests, behavioral objectives, overviews, and advance organizers. *Review of Educational Research*, Vol. 46, 239-265.
29. Hartley, J., Goldie, M., & Steen, L. (1979). The role and position of summaries: Some issues and data. *Educational Review*, Vol. 31, 59-65.
30. Hartley, J., Kenely, J., Owen, G., & Trueman, M. (1980). Underlining can make a difference-sometimes. *Journal of Educational Research*, Vol. 73, 218-224.
31. Hartley, J. & Trueman, J. (1982). The effects of summaries on the recall of information from prose: Five experimental studies. *Human Learning*, Vol. 1, 63-82.
32. Hartley, J. & Trueman, M. (1985). A research strategy for text designers: The role of headings. *Instructional Science*, Vol. 14, 99-155.
33. Holley, C.D., Dansereau, D.F., Evans, S.H., Collins, K.W., Brooks, L., & Larson, D. (1981). Utilizing impact and embedded headings as processing aids with nonnarrative text. *Contemporary Educational Psychologist*. Vol. 6, 227-236.
34. Hurt, J.A. (1987). Assessing functional effectiveness of pictorial representations used in text. *Educational Communication and Technology Journal*, Vol. 35, 85-91.
35. Jenkins, J.R. & Deno, S.L. (1971). Influence of knowledge and type of objectives on subject matter learning. *Journal of Educational Psychology*, Vol. 62, 67-70.
36. Jonassen, D.H. & Kirschner, P.A. Introduction to section two: Explicit techniques for structuring text. In Jonassen, D.H. (1982). *The Technology of Text: Principles for Structuring, Designing, and Displaying Text*. Educational Technology Publications. Englewood Cliffs: NJ.
37. Keller, J.M. (1987). Strategies for stimulating the motivation to learn. *Performance and Instruction*, 26(8), 1-7.
38. Larkin, J.H. & Simon, H.A. (1987). Why a diagram is (sometimes) worth ten thousand words. *Cognitive Science*, Vol. 11, 65-99.
39. Levie, W.H. (1987). Research on pictures: A guide to the literature. In D.M. Willows & H.A. Houghton (Eds.), *The Psychology of illustration: I. Basic Research*. New York: Springer-Verlag.
40. Lorch, R.F., & Lorch, E.P. (1996). Effects of organizational signals on free recall of expository text. *Journal of Educational Psychology*, Vol. 88(1), 38-48
41. Lorch, R.F. Jr, & Lorch, E.P. (1985). Topic structure representation and text recall. *Journal of Educational Psychology*, 77, 137-148.
42. Luiten, J., Ames, A., & Ackerson, G. (1976). A meta-analysis of the effects of advance organizers on learning and retention. *American Educational Research Journal*, Vol. 17, 211-218. In Jonassen, D.H. (1982). *The technology of text: Principles for structuring, designing, and displaying text*. Englewood Cliffs, NJ: Educational Technology Publications.
43. Mager, R.F. (1975). *Preparing instructional objectives*. Palo Alto, CA: Fearon Publishers.
44. Mayer, R.E. (1979, Summer). Can advance organizers influence meaningful learning? *Review of Educational Research*, Vol. 49(2), 371-383.
45. Miller, G.A. (1956). The magical number seven, plus or minus two: Some limitations on our capacity for processing information. *Psychological Review*, Vol. 63, 81-97.

46. Newsom, R.S., & Gaitte, A.J. (1971). Prose learning: Effects of pretesting and reduction of passage length. *Psychological Reports*, 28, 123-129.
47. Nist, S.L., & Hogrebe, M.C. (1987). The role of underlining and annotating in remembering textual information. *Reading Research Instruction*, Vol. 27, 12-25.
48. Oliver, R. (1999). Exploring strategies for online teaching and learning. *Distance Education*, 20(2), 240-250.
49. Reder, L.M., & Anderson, J.R. (1980). A comparison of texts and their summaries: Memorial consequences. *Journal of Verbal Learning and Verbal Behavior*, Vol. 19, 121-134.
50. Richards, C. & Johnson, R. (1980). Graphic codes for flowcharts. *Information Design Journal*, 1, 261-270.
51. Rickards, J.P. & Denner, P.R. (1978). Inserted questions as aids to reading text. *Instructional Science*, Vol. 7, 313-346.
52. Rothkopf, E.Z. & Kaplan, R. (1972). Exploration of the effect of density and specificity of instructional objectives on learning from text. *Journal of Educational Psychology*, Vol. 63, 295-302.
53. Weidenmann, B. (1989). When good pictures fail: An information processing approach to the effect of illustrations. In H. Mandl & J.R. Levin (Eds.), *Knowledge acquisition from text and pictures*. Amsterdam: Elsevier.
54. Wilhite, S. (1989). Headings as memory facilitators: The importance of prior knowledge. *Journal of Educational Psychology*, Vol. 81(1), 115-117.
55. Wilson, T.C., Pfister, F.C., & Fleury, B.E. (1981). The design of printed instructional materials: Research on illustrations and typography. *Eric Clearinghouse on Information Resources*, Document 13210.

# Incorporating Academic Standards in Instructional Systems Design Process

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## Abstract

*Almost every state is “imposing” academic standards. Helping students to meet those standards is a key task for teachers, school administrations, as well as instructional systems designers. Thus, instructional designers in K-12 environments are facing the challenge of using appropriately and effectively academic standards in their instructional systems design process. This presentation offers some effective ways of handling academic standards in the instructional systems design process together with examples. It is hoped that this presentation will encourage experts in both academic standards and ISD to examine the role and influence of academic standards on ISD processes and the subsequent outcomes.*

## 1. Introduction

Many states are “imposing” academic standards which need to be addressed in instructional systems design (ISD) process and incorporating academic standards effectively becomes a crucial skill for instructional designers in K-12. This presentation examines effective ways of incorporating academic standards in ISD process. Examples of how academic standards can guide and help ISD process will also be discussed. Another goal of this presentation is to encourage experts in both academic standards and ISD to examine the role and influence of academic standards on ISD processes and the subsequent outcomes.

## 2. Defining terms

Academic standards in this presentation will refer to the official documents from the national, state department of education or local educational commission that define what each student should know and do in a core set of subjects. They are academic targets for students, teachers and parents to meet. *Proposed Academic Standards for Science and Technology* by Pennsylvania Department of Education is an example of such state-defined academic standards.

Instructional Systems is better known as Educational Technology or Instructional Technology. It is defined as “the theory and practice of design, development, utilization, management and evaluation of processes and resources for learning” (Seels & Richey, 1994, p.1, the AECT Definitions and Terminology Committee, 2000). Its ultimate purpose is to improve effectiveness and efficiency of human learning. Instructional systems design (ISD) in this article refers to the systematic process of planning instructional systems, specifically the process of analysis, design, development, implementation and evaluation of instructional programs.

## 3. Relationships between academic standards and instructional system design

Academic standards are constructed to give students a solid foundation in the basics and to provide consistent targets for students, teachers and parents. They allow schools to measure student achievement. They help parents, teachers, school administration and school districts follow the progress that students make from year to year. “Done right, aligned standards and assessments give us something that standards and curriculum objectives, by themselves, never delivered: the ability to see how well we are performing and how much we are improving.” (Pennsylvania Department of Education, 2001. online: <http://www.pde.psu.edu/standard/backgrnd.html>)

The importance of academic standards has long been recognized in education. Studies related to academic standards range from the characteristics of good academic standards to their influence in facilitating educational reforms and students’ achievements. Setting up good academic standards is important. However, how to help students to meet those standards are the real purposes. This is where the academic standards and ISD meet. According to the definition above, the ultimate purpose of ISD is to make the learning maximally effective and efficient. Therefore, in K-12 environments, the ultimate purpose of ISD is to help the students achieve those academic standards effectively and efficiently.

#### **4. Incorporating academic standards in instructional systems design**

All the academic standards should be measurable, applicable and clearly written. When applying the academic standards in instructional systems design, they might not be so either because of standards themselves or the limits of resources available to apply them. The author summarizes the following ways to incorporate academic standards appropriately and effectively in ISD. They are to be discussed in the four aspects (1) systemic approach in incorporating academic standards, (2) academic standards as ISD guide, (3) flexible use of academic standards in ISD, and (4) moving beyond academic standards.

##### **4.1. Systematic approach of incorporating academic standards**

The systemic approach in ISD refers to the way in which instructional systems designer takes every aspect of ISD into consideration in order to produce effective instructional programs. It should be differentiated from systematical approach. The systematical approach is linear, step-by-step approach while the systemic is integrated, holistic approach in ISD efforts (Banathy, 1996).

A systemic approach in incorporating academic standards in ISD process should take following into considerations and balance between what should be done and what could be done:

- Which academic standards should be included in the ISD programs that can help the students most?
- Which academic standards should be included in the ISD programs that are in alignment with the project rationale and goals, and student and school needs?
- Which academic standards should be included in the ISD programs according to the availability of resources (personnel and financial resources, equipment and facilities resources, technical and content support, and time constraints, etc.)?
- How much academic standards should be included in the ISD programs according to the availability of resources (personnel and financial resources, equipment and facilities resources, technical and content support, and time constraints, etc.)?

The systemic approach ensures the effectiveness and efficiency of incorporating academic standards in ISD.

##### **4.2. Academic standards as the ISD project guide**

Academic standards can be used as ISD project guide. Instructional systems designers can refer to academic standards to establish ISD project rationale and project goals. This is especially true in writing grant proposal for ISD project. In analyzing phase of ISD, academic standards can provide guidance and references on specific learning objectives for the ISD program. This ensures that contents of ISD programs designed and developed are right on the target by defining what the students are supposed to learn and help them to learn well to meet the standards. In implementing and evaluating of ISD programs, the academic standards may also provide instructional systems designer with what to assess or basis for what to assess. Many academic standards can provide yardsticks for both summative and formative evaluation in the ISD programs. The rubrics or criteria for assessment can be directly developed from the academic standards. All these help to increase the validity of the assessments involved in ISD programs.

To use academic standards as a guide appropriately, it is always advisable for instructional systems designers to consulting with subject matter experts and the schoolteachers who are going to use the ISD programs eventually in their classrooms. It is very important to make sure that you have reached a consensus in explaining and understanding the specific academic standards that the ISD program is to include. Otherwise, there is no way for the teachers to use the ISD program effectively if it conflicted with their beliefs and understanding.

##### **4.3. Flexible use of academic standards in ISD**

Academic standards are important to instructional systems designers and how to incorporate them appropriately in ISD process is crucial for those work in K-12 environment. Academic standards provide general guidance in terms of learning content for ISD programs. However, in most of the cases, they cannot be directly used as learning objective for ISD programs. A competent instructional designer should be able to use academic standards flexibly.

There are three effective ways of using academic standards without comprising their quality and quantity. They are (1) deriving learning objectives for a single ISD program unit from multiple standards, (2) deriving learning objectives for multiple ISD program units from single standard, and (3) deriving learning objectives for multiple ISD program units from multiple standards.

1. For a single ISD program unit, the learning objectives can be derived from multiple standards. (Please see **Example 1: Multiple standards for a single ISD program unit.**)
2. The learning objectives for multiple ISD program units can be derived from a single academic standard. (Please see **Example 2: A single standard for multiple ISD program units.**)
3. The learning objectives for multiple ISD program units can be derived from multiple academic standards. Although none of the ISD program units fully covers a single academic standard, the multiple units cover all the targeted academic standards and may overlap. (Please see **Example 3: Multiple standards for multiple ISD program units.**)

#### 4.4. Moving beyond academic standards

Academic standards should be the guide and references for ISD rather than the obstacles and constraints. A competent instructional systems designer should not only be able to use them flexibly but also be able move beyond academic standards in ISD. This can be done mainly in two ways. First, ISD should not only aim at accomplishing the target standards but also aim at preparing the learners to achieve higher academic standards. For example, in designing a lesson of biology for the 5<sup>th</sup> grade students, instructional system designer should not only consider the present learning target but also prepare the students to achieve those academic standards in their future study. Maybe you could find that some of the academic standards for the 6<sup>th</sup> grade students can be partially incorporated in your design for the 5<sup>th</sup> grade.

Another way of moving beyond the academic standards in ISD process is to integrate academic standards of different subjects into your ISD programs whenever possible. For example, in designing computer-assisted lesson of biology, the academic standards of science and technology can be easily integrated together. In developing a lesson of environment protection, the academic standards in writing can be integrated together. For instance, in **Example 1: Multiple standards for a single ISD program unit**, the learning objectives for ISD program are derived from academic standards for 4<sup>th</sup> grade students. The academic standards are from different subjects of study (Environment and Ecology, and writing) and for different grades (grade 4 and grade 5). The integration of academic standards from different areas of learning would foster the learners' development in all fields of studies.

#### 5. Conclusion

For instructional systems designers in K-12 environments, academic standards mean a lot. "The program rationale must be based on the academic standards, otherwise, we will never get the grant." "We have to cover these standards as required by the grant." "Derive program objectives according to the academic standards and also remember to assess the learners according to them. We need a report on that." Like it or not, these are common statements and actual practices of ISD in the field of K-12. The practical ways mentioned above can help instructional systems designers in K-12 incorporate academic standards appropriately and effectively in ISD process and help more students meet their academic standards.

Also, it is hoped that this article would bring more experts both in the fields of academic standards and instructional systems design to study the effective and efficient ways of incorporating academic standards in ISD processes and their subsequent outcomes. It is obvious that the efforts of study academic standards in ISD process will benefit a lot both students and teachers in K-12 education.

*Example 1: Multiple standards for a single ISD program unit*

Multiple Academic Standards	Learning Objectives for a ISD Program Unit
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<p><b>Academic Standards for Environment and Ecology (Pennsylvania Department of Education, 2001)</b> 4.9.4 Grade 4 <b>A. Know that there are laws and regulations for the environment</b></p> <ul style="list-style-type: none"> <li>Identify local and state laws and regulations regarding the environment</li> <li>Explaining how the recycling law impacts the school and home</li> <li>Identify and describe the role of a local or state agency that deals with environmental laws and regulations</li> </ul>	<p><b>Lesson Objectives derived from the academic standards</b></p> <ol style="list-style-type: none"> <li>Given examples of environmental laws and regulations, the student will be able to categorize them correctly (85%) into three main categories (Air, Water, and Pesticides and other pollutants).</li> <li>Student will be able to discriminate correctly (95%) between recyclable and non-recyclable items in their daily life both at school and home.</li> <li>The student will be able to describe in writing the following roles of a local or state environmental agency that deals with environmental laws and regulations.             <ol style="list-style-type: none"> <li>Monitoring environment</li> <li>Environmental law enforcing</li> <li>Gathering and sharing information on environment</li> </ol> </li> </ol>
<p><b>Academic Standards for Environment and Ecology (Pennsylvania Department of Education, 2001)</b> 4.2.4 Grade 4 <b>D. Identify by products and their use of natural resources</b></p> <ul style="list-style-type: none"> <li>Identify those items that can be recycled and those that cannot.</li> </ul>	
<p><b>Academic Standards for Reading, Writing, Speaking, and Listening</b> 1.4.5 Grade 5 <b>B. Writing multi-paragraph informational pieces (e.g. essays, descriptions, letters, reports, instructions.)</b></p> <ul style="list-style-type: none"> <li>Include cause and effect.</li> <li>Develop a problem and solution when appropriate to the topic</li> <li>Use relevant graphics (e.g. maps, charts, graphs, tables, illustrations. Photographs).</li> </ul>	

Example 2: Single academic standard for multiple IDS program units

Single Academic Standard	Learning Objectives for Multiple ISD Program Units
<p><b>Academic Standards for Sciences and Technology (Pennsylvania Department of Education, 2001)</b> 3.3.4 Grade 4 <b>A. Know the similarities and differences of living things</b></p> <ul style="list-style-type: none"> <li>Identify life processes of living things (e.g. growth, digestion, react to environment).</li> <li>Know that some organism have similar external characteristics (e.g. anatomical characteristics; appendages, types of covering, body segments) and that similarities and differences are related to environmental habitat.</li> <li>Describe basic needs of plants and animals.</li> </ul>	<p><b>Objectives for Unit One</b></p> <ol style="list-style-type: none"> <li>Given an example of living animal or a plant that student are familiar with, students will be able to clearly describe its life process by using concepts of growth, digestion, and its external characteristics.</li> </ol>
	<p><b>Objectives for Unit two</b></p> <ol style="list-style-type: none"> <li>Students will be able to describe the basic needs of plants and animals and explain how living things are dependent on other things—both living and nonliving—in the environment for survival by using examples that they are familiar with</li> </ol>

Example 3: Multiple academic standards for multiple IDS program units



Multiple Academic Standards	Learning Objectives for Multiple ISD Program Units
<p><b>Academic Standards for Sciences and Technology (Pennsylvania Department of Education, 2001)</b> 3.7.4. Grade 4 <b>D. Use basic computer software.</b></p> <ul style="list-style-type: none"> <li>• Applying operating system skills to perform basic computer tasks.</li> <li>• Apply basic word processing skills.</li> <li>• Identify and use simple graphic and presentation graphic materials generated by computer.</li> <li>• Apply specific instructional software</li> </ul>	<p><b>Objectives for Unit 1</b> <i>Given the category type of search engine, the students will be able to locate information needed to solve the given problems that are appropriate to their age by</i></p> <ul style="list-style-type: none"> <li>• Forming up appropriate questions</li> <li>• Identifying the key words to location information needed</li> <li>• Being selective (critical) towards information found online</li> <li>• Using the information founded to solve given problem</li> <li>• Using email format to communicate solutions</li> </ul>
<p><b>Academic Standards for Sciences and Technology (Pennsylvania Department of Education, 2001)</b> 3.7.4. Grade 4 <b>E. Identify basic computer communication systems.</b></p> <ul style="list-style-type: none"> <li>• Apply a web browser.</li> <li>• Apply basic electronic mail functions.</li> <li>• Use online searches to answer age appropriate questions.</li> </ul>	<p><b>Objectives for Unit 2</b> <i>1. Given student a business web site, the students will be able to identify correctly the basic components web site including</i></p> <ul style="list-style-type: none"> <li>• URL</li> <li>• Site title and site content (Navigation bars, contact information)</li> <li>• Description of the company (Name, address, company logo and contact information)</li> <li>• Products and services</li> <li>• Date of site information updated</li> </ul> <p><i>2. Students will be able to use graphic designing principles to evaluate the site design in terms of</i></p> <ul style="list-style-type: none"> <li>• Easy to read</li> <li>• Layout of website</li> <li>• Consistency in graphic presentation</li> </ul>
	<p><b>Objectives for Unit 3</b> <i>Given a web design template, student will be able to design a business site for advertising company products and services by following graphic principles in unit 2.</i></p>

**References**

AECT Definition and Terminology Committee, 2000. Online: <http://www.aect.org/Affiliates/National/Standards.pdf>

Banathy, B. H. (1996). "Systems Inquiry and Its Application in Education, ch. 3" in Handbook of *Research for Educational Communications and Technology*. D.H. Jonassen (ed.) NY: Simon & Schuster

Pennsylvania Department of Education. (2001). *Academic Standards for Environment and Ecology*. <http://www.pde.psu.edu/standard/ecology.pdf>

Pennsylvania Department of Education. (2001). *Academic Standards for Sciences and Technology*. Online: <http://www.pde.psu.edu/standard/science.pdf>

Seels, B. B. & Richey, R. C. (1994). *Instructional Technology: The Definition and Domains of the Field*. Washington, DC: Association for Educational Communications and Technology.

# Using Developmental Research to Study One's Teaching of an Instructional Design Course

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## Abstract

*This five-year study of two instructors teaching a master's level instructional design course used developmental research to systematically examine a reflexive teaching approach. The reflexive teaching model is described. Eight data sources across six deliveries of the course were analyzed in terms of design decisions (i.e., the teaching model), model implementation, and model evaluation. Methodological issues of this developmental research study are discussed, including data management of evolving data sources, data analysis of teaching artifacts, and the balancing of teaching goals and research objectives. Guidelines for using developmental research to study one's teaching are summarized.*

## Developmental Research

We view developmental research as co-contributing to the development of educational interventions (models and other processes, courses, media/technology artifacts), as well as knowledge about this development in the form of design principles or frameworks. Developmental research uses a developmental cycle, consisting of design, development, implementation, and evaluation activities, to formally study these interventions over time. The intent of developmental research is partly pragmatic design, developing products or processes that are needed to serve human needs (Norman, 1993). The intent is also to learn from our design efforts, to formulate what we learn so that these principles and frameworks assist us in developing other interventions in different contexts.

Reeves (2000) reminds us that the aims of any research depend on the researcher's epistemological lens, which in turn influences the selection of one's research goals and research framework. For example, development goals differ from empirical goals. While empirical research is characterized by a researcher using research hypotheses and the testing of these hypotheses to refine existing theory, developmental research involves collaborators in the analysis of practical problems with the testing of designed solution in actual practice. The outcome of developmental research is initially a greater understanding of the educational artifact, process, or intervention and ideally design principles generalizable at some level, whether it be to refine the artifact, process, or intervention under study or transfer to other applications or contexts.

Richey and Nelson (1996) provide a comprehensive review of developmental research projects, which they classified as either Type I or Type II studies. Type I studies involve the design and development of products or processes within a developmental cycle, while in Type II studies researchers study what has already been developed with the intent of abstracting design principles for re-use. Meanwhile, van den Akker (1999) labels Type I as formative studies in which the goal is optimizing an intervention, while Type II studies are labeled as reconstructive studies and formulate design principles. In addition, van den Akker characterizes design principles to include substantive knowledge on "What to design?" and procedural knowledge, or "How should it be developed?" To add to our knowledge of what to design and how to design, says van den Akker, design principles should be justified by theoretical arguments, procedural detail, empirical evidence, and validated in multiple contexts.

Informing developmental research is formative research (e.g., Newman, 1990), which (a) identifies shortcomings and providing suggestions to a product or a process under development; (b) uses triangulation of methods, instruments, sources, and settings; and (c) evaluates quality criteria, such as effectiveness appeal/practicality, and efficiency. Complementing formative research are design experiments (Brown, 1992), involving the design and study of learning environments addressing complex learning problems in actual learning settings with practitioners. In using design experiments Brown reminds us how mutually informative studies done in classroom and laboratory settings can be. Decisions facing the researcher in design experiments, according to Brown, include participant size, involving individualized cases studying subject traits or the use of many subjects looking at a single variable. A second decision deals with changes over a chosen length of time, including cross-sectional studies from different groups, longitudinal data from a group over time, or microgenetic studies examining data over a short period of time. A third decision is the appropriate choice or mix of quantitative and qualitative techniques to use.

This paper discusses the methodological issues of using a developmental research framework to systematically design, implement, and evaluate a process; in this case, a reflexive approach for teaching instructional design (ID). The next section of the paper describes the developmental study, including the reflexive teaching model, the instructional sequence of the ID course, the developmental research framework, and study conclusions. A subsequent section will discuss methodological issues of developmental research, including data management and analysis, and the challenges of teaching and studying one's teaching. A final section provides guidelines on teaching decisions and matching developmental research prompts.

## Developmental Study of ID Instruction

### *Reflexive Teaching Model*

The major components of our reflexive approach for teaching instructional design include (a) characteristics and roles of instructor and learner, (b) co-participation structures, and (c) dialogue of teacher and student within each participation structure. Teachers and students are viewed as learners, each possessing unique learning beliefs, knowledge, competencies, experiences, sensibilities, and motivations. The instructor roles within the model include that of a learner, a designer of an instructional environment, and a teacher responsive to learner needs within this environment. The teacher assumes a supportive role, not unlike that of a coach (Schön, 1987). In terms of knowledge and competencies, the teacher must bring not only expertise in instructional design, but subject matter knowledge, pedagogical knowledge, pedagogical content knowledge, and knowledge of the learning principles of instructional design (Shulman, 1986). Student roles in the reflexive model include that of a learner with a willingness to engage within the participation structures and perform learning tasks. By reflexive we mean instructor and student learning of instructional design through multiple forms of activity.

Participation structures include the classroom, learning tasks (outside of the classroom), individual conferences, electronic mail, web site, and texts. Although careful consideration must be given to the design of these structures, some negotiation of their features by students is also encouraged. The key is being open to feedback and periodically "stepping outside" a teacher's perspective to consider these suggestions. Dialogue between the participants is crucial within these structures. For example, in a group activity, dialogue enables the knowledge of instructional design and one's views and experiences to be shared in an open and testable way, initiating a shared reflective process. Cooperative learning, presentations, and peer/teacher evaluations are key strategies. Within the structures dialogue with oneself through reflective tasks promotes ID understanding and understanding of one's own thought processes. Weekly written project drafts and feedback on one's performance help to develop reflective activity.

### *Instructional Sequence*

The first two phases in the ID process in this course, Learning Beliefs and Design Tools (principally ID models), are used to establish the context for the traditional ID process (see Figure 1). Design-A-Lesson and Learning Principles tasks help students to reflect on how they currently plan instruction and their views on learning. Students draft a Mission Statement, which is used to assess how students' learning beliefs are being applied in their projects. Students also sketch a visual of their own ID model and provide an explanatory narrative.

#### *ID INSTRUCTION: Instructional Design Phases*

Setting the Context for ID		ID Project Development						Self Assessment	
Learning Beliefs	Design Tools	Needs Assessment	Lesson Sequence	Instructional Framework	Assessment	Media throughout	Prototype	Program Evaluation	

#### *ID PROJECT: Learning Tasks*

Design A Lesson Learning Principle	Prelim. ID Model	<i>Project Intent Statement</i> Needs	Sequencing Plan	Instructional Framework	Assessment	Teaching Demos and Prototype	Teaching Demos and Prototype	Revised ID Model Revised Self
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Mission Statement		Assessment and Goals				Lesson	Lesson	Evaluation
		Conference					Conference	

*Figure 1. Course sequence and learning tasks.*

Students choose an instructional problem for an ID project and record their initial understanding of the problem through an Intent Statement. The Needs Assessment phase structures students' research into the instructional problem and options for addressing it. A personal conference provides individual assistance with their needs assessment strategy in terms of what to study, with whom to talk, what references to consult, and how to summarize their findings. Based on Needs Assessment, students identify goals for their project. Following Needs Assessment, students are introduced to design phases, which include Instructional Sequence, Assessment, Instructional Framework, Instructional Media/Technology, and a Prototype Lesson. Instruction helps raise students' awareness to the purposes of assessment and appropriate assessment methods. During the Instructional Frameworks phase in which teaching options are specified, students demonstrate a teaching strategy in their Prototype Lesson. Instructional Media and Technology is addressed throughout the course beginning with Needs Assessment. We urge students to be open to a range of media and technology possibilities and to make a case for how their choices support their goals. A second personal conference addresses Program Evaluation and individual project issues. The final week of the course has students submit revised personal ID models and a written self-evaluation of the course and their learning.

### ***Developmental Research Methodology***

To study the reflexive teaching approach, the design and development cycle (Richey & Nelson, 1996) was adopted as a research framework for six deliveries of an ID course from 1994-1998. In developmental research, objectives, rather than questions, characterize the inquiry. In this study we were interested in how the reflexive approach developed over time, and our research objectives for each delivery of the course included the following:

- Describe the design decisions.
- Describe the implementation of the model, or what occurred during each delivery.
- Describe the evaluation of the model, in terms of student learning and student perceptions of their learning and teaching.

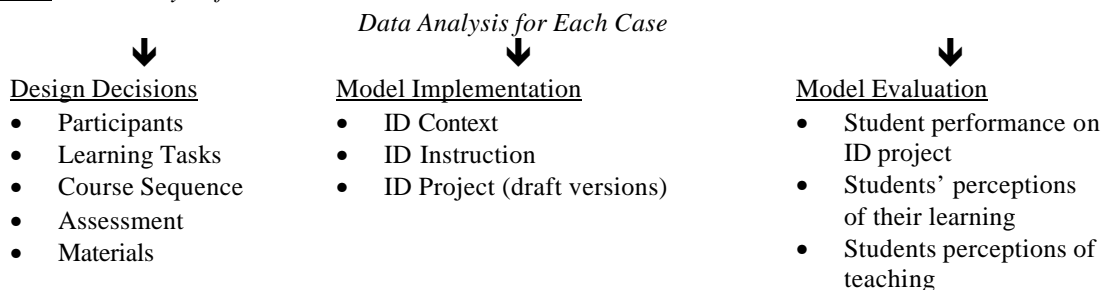
The case study, defined as each class delivery, was chosen as the unit of analysis to describe the course development (Yin, 1994). Case 1 was a 5-week summer course with nine contact hours per week. Cases 2-5 were 15-week semesters, which met for three hours per week. Case 6 involved K-12 teachers from a school district/university-sponsored master's program, during a 15-week spring semester, which met off-campus for 3 hours once per week.

Participants included 113 students and two instructors in a master's level instructional design course from a university's instructional technology graduate education program. Of the 113 students, 73 had teaching experience. Educational levels of interest included 18 elementary school, 15 middle school, 26 high school, 6 with an overall K-12 interest, 29 college, and 19 training. The largest content area focus of the participants included science and technology (19), followed by language (17), computing (14), and special education (12).

Eight different data sources were used (see Figure 2), providing us with a means of data triangulation in which different sources of information informed the three research objectives (Yin, 1994). Data sources for design decisions included working logs, e-mail, and syllabi. Working logs documented our thinking and involvement in the ID course, including class presentations, learning tasks, student guide content, and teaching model representations. A syllabus recorded major design decisions for each case, including course purpose, instructional materials, assessment, and course sequence.



Figure 2. Data analysis framework



Data sources for implementation of the reflexive approach included working logs, e-mail, draft ID projects, and personal conference notes. Whenever possible during class, student comments and observations of class activities and student/instructor performance were recorded in working logs. Outside of class working logs recorded our perceptions of what occurred in class, summaries of weekly submissions of student work, and notes from weekly instructor meetings. E-mail was a source of instructor dialogue on weekly shifts in instruction and student needs. Draft ID projects provided evidence on how students transferred their ID process understanding into design decisions. The first of two personal conferences between instructors and student met early in the semester to discuss a student's project choice and needs assessment strategy.

Data sources for evaluation of the model included students' completed projects, course evaluations, student evaluations of their learning and written notes from a second personal conference. Required project components included a Mission Statement of beliefs about learning/learners/instruction, Project Intent Statement, Needs Assessment, Sequence, Assessment Plan, Instructional Framework, Instructional Media/Technology Plan, a Prototype Lesson, and a Program Evaluation Plan (formative and summative). Course evaluations included Likert-scale questions to record student perceptions of instruction, instructors and materials. Students also completed open-ended questions, which asked them to rate and/or comment on learning tasks and instructional materials. The self-evaluation task varied over each course delivery but typically asked students to summarize what they learned in the course, what they would like to learn next, and comment on their experiences with the course. Finally, a second student-teacher conference was conducted at the end of the course to address student questions on their projects.

For each case the design decisions were reported by describing (a) participants, (b) learning tasks, (c) course sequence, (d) assessment, and (e) instructional materials. Analysis of the implementation of the model for each case was reported by describing student performance and responses to instruction and instructor's assistance during (a) ID context activities, (b) ID process instruction, and (c) draft ID projects. Evaluation of the teaching model was reported on the basis of summarizing (a) student performance on the ID project, (b) students' self-perceptions of their learning, and (c) instructor responsiveness to student needs. Details of the data collection and analysis procedures can be found in Shambaugh and Magliaro (2001).

## Developmental Study Conclusions

What we learned from this developmental study fall into two categories that also match our view of developmental research: a greater understanding of (a) a process; in this case, a reflexive teaching approach for ID instruction, and (b) the use of developmental research to study ID instruction.

*Reflexive model understanding.* A summary of what we learned about the teaching model is elaborated below.

- *Articulate the theoretical basis for a reflexive approach:* learning is constructed by the individual (Bruner, 1990), that there is a developmental interplay between one's thinking and the social world (Brown, Collins & Duguid, 1989; Fosnot, 1996; Lave & Wenger, 1991), and that teaching supports learning construction through multiple forms of assistance (Tharp & Gallimore, 1988). Teaching is not viewed as content delivery or communicating knowledge but the development of learning environments to support individual knowledge construction (Duffy & Cunningham, 1996).
- *The social system in which our reflexive teaching was embedded:* a reflexive stance regards teacher and student as mutual learners with different roles, both involved in a critical, self-appraisal of their activity within the learning environments (i.e., the participation structures).
- *Classroom syntax:* Out of this study the classroom participation structure was characterized by three phases, including (a) setting the stage, (b) representing understanding by instructor and student, and (c) debriefing. Our assistance to student learning was also depicted in a responsiveness cycle involving (a) design and implementation; (b) mutual engagement, performance, and reflection; and (c) submit learning tasks, query instructors on issues, and respond to student concerns.
- *Principles of student reaction:* How students reacted to the teaching are summarized by individual ID phases.
- *Support system requirements:* In this model students were new to learning beliefs examination, were sometimes uncomfortable with submitting work-in-progress versus finished work, were new to detailed feedback from instructors, and required some time to take responsibility for design decisions responsive to learners versus what instructors wanted.
- *Requirements for co-participation:* Joint student-instructor learning required a (a) willingness to share control and responsibility for learning, (b) a readiness for dialogic education, and (c) a genuine desire to be reflexive in one's teaching and learning.

*Developmental research understanding.* Our understanding of what it meant to study our teaching using a development research framework included the following.

- *Model representation:* our description of the model provides a basis for subsequent development of the model for purposes of exploration, prediction, and planning.
- *Model development:* a theoretical basis for a model must be articulated and one must be clear as to the purposes of the developmental study to study the model; in particular, what knowledge, understanding, or predicting is being developed.
- *Data management:* maintaining systematic data management procedures are crucial to track the evolution of the model prototype and to make any generalizations across time.
- *Individual and collaborative requirements:* a reflexive disposition is needed to study one's teaching.

## **Developmental Research Issues**

This section provides more details on methodology issues involved in the above developmental research study.

### ***Data Management and Analysis***

Data management in developmental research involves the procedures for a systematic, coherent process of data collection, storage and retrieval for the purpose of high quality, accessible data, the documentation of analysis, and retention of data (Huberman & Miles, 1998). In this study data were analyzed using the qualitative techniques of Miles and Huberman (1994), which consisted of data reduction from original data sources using categorical analysis (Spradley, 1980) and display of this reduced data in “frames” or tables that enabled conclusions to be drawn. The data analysis sequence included collecting data, reducing the data into frames, and reporting the

reduction in an analysis section. The data reduction documents for each case were kept in 3-ring notebooks and each notebook was divided by data sources, a strategy that served to separate the data from the report and provided a means to organize the data and track the analysis sequence from data source to data reduction to data reporting.

Describing design decisions was straightforward. Syllabi concisely recorded these as well as what was written in working logs, which recorded dialogue between instructors over time as to what ID content means and how to teach this content. Implementation of these design decisions in an actual course was also relatively clear to record in Working Logs in terms of what we as instructors implemented and how students reacted to these decisions from what they said and what they designed during the semester. Weekly submissions of draft ID project components were evaluated in terms of performance criteria. Criteria for each project component were communicated to students using a task sheet.

Evaluation of student learning was more complicated. The ID projects were the principal source to indicate student performance of ID understanding and were analyzed for (a) completeness (i.e., Were all of the project components in place?), (b) consistency of learning beliefs across design components, and (c) coherence of design components. For consistency, important ideas (e.g., assisting learners, skill proficiency, working together, problem solving, multiple instructional approaches) were identified from a Project Intent Statement. The ID project was reviewed to note whether or not these ideas were explicitly addressed in the projects. For example, if a student wrote about the importance of students working together, we looked for this feature in the instructional approach, activities, or prototype lesson. A Mission Statement recorded what students believed were important teaching and learning principles. The ID project was reviewed to note whether or not the features of the Mission Statement were addressed in the projects. For coherence, notations were recorded in terms of how each design component was represented. A judgment was made whether or not these design components appropriately supported each other, such as a match between assessment methods and teaching.

Each case was a description of “what happened and how the course proceeded” using design decisions, model implementation, and evaluation of the model as a way to describe the use and results of the model (between-case analysis). Data displays, structured summaries, and tables allowed a condensed view of the data sources and revealed that some further analysis was needed, such as coding of structured summaries to reveal themes as well as to identify exceptions and differences.

The summary of an across-case analysis of the six cases (across-case analysis) reported the changes in design decisions, implementation, and evaluation of the model (see Shambaugh & Magliaro, 2001). As Huberman and Miles (1998) have commented, “each case has a specific history—which we discard at our peril—but it is a history contained within the general principles that influence its development” (p. 194). This summary attempted to preserve the uniqueness of each case, yet also make comparisons along the developmental cycle based on repeat deliveries of the course. In an effort to extend external validity, what participants’ “did, said, or designed,” were examined in multiple settings. The description of the reflexive model, based on what was found from this analysis, provided a set of generalizations on how the model was implemented, as well as conditions necessary for its use. The danger to this generalization was that “multiple cases will be analyzed at high levels of inference, aggregating out the local webs of causality and ending with a smoothed set of generalizations that may not apply to any single case” (Huberman & Miles, p. 194). We did not average, for example, course evaluation results (i.e., from Likert scales) to avoid misinterpretation and superficiality and to preserve case uniqueness. The goal was to better understand the overall processes at work across the cases, including teacher and student thinking, participation, and teacher responsibility.

In traditional instances of qualitative data collection and analysis, the research “shifts between cycles of inductive data collection and analysis to deductive cycles of testing and verification” (Huberman & Miles, 1998, p. 198). In this study, sources of data were already in place prior to conceptualizing a study framework. However, the details of the framework and the subsequent data analysis of the six cases cycled back and forth to realize more appropriate matches of methodology and method to existing data sources and research objectives. The analytic cycle for this study could be better described as one that moved between conceptual framework, case analysis, and study purpose. Although being clear as to the purpose of a study is preferable before constructing a methodology, such clarity is not always possible due to the complexity of processes to be studied, data, and personal involvement over time. This reality requires teachers-researchers who feel comfortable about this dynamic movement and emergence of understanding.

One possible source for bias in this study is the large amount of data, which may have led to missing important information or overweighing some findings due to focusing on a particular and large set of data. Personal involvement with the course also increased the possibility that recorded observations in working logs highlighted particular incidents while ignoring others. The working logs, however, served as a “reflexivity journal” (Carney, 1990) and recorded observations or design decisions that would have been lost to our collective memories over the

five years of involvement. Personal involvement as co-instructors also implied a danger in being selective and overconfident with some data. Another shortcoming was not checking descriptions with each case of students and additional peer review outside of the co-instructor.

To address these shortcomings, we used multiple data sources for triangulation to achieve an agreement of one data source with another. Multiple sources of data, such as working logs, e-mail, and syllabi, also provided different strengths and complemented each other. Syllabi, for example, compactly recorded design decisions, while working logs and email documented our thinking that influenced these decisions. The data sources were a mix of student-generated (i.e., conferences, ID projects, course and self-evaluations) and instructor-generated (i.e., working logs, e-mail, syllabi) data.

During the analysis of these data sources we looked for contrasts, comparisons, and exemplars and reported these during the data reduction so as not to filter out outliers and extreme instances. Replication of the conceptual framework across multiple cases helped to provide evidence that what was described in each case was based upon the details of the instructional approach and uniqueness of the setting and participants. We were conscious to remain “descriptive” in the writing during the analysis of each case.

Another means of addressing verification of methodology, findings, and conclusions was an “auditing” by the co-instructor. Through periodic reviews of methodology and analysis, inconsistencies in design decisions were identified and prompted for clarification. Such feedback characterized another aspect of our reflexive stance, the need to assume regular, ongoing, and self-conscious documentation of teaching.

### ***Balancing Design-Teaching and Developmental Research***

The design decisions, implementation, and evaluation of the ID course were event-driven, meaning that they served our instructional needs to watch, ask, and examine (Wolcott, 1992). These observations, interviews, and documents were in place prior to the conceptual framework of the study. As a result, the data sources were not as complete, tightly defined, or structured across the six cases if they had been researcher-driven. Some data sources, such as syllabi, course evaluations, and self-evaluations, evolved to suit the learning needs of the students. However, because we had presented preliminary findings at research conferences (e.g., Shambaugh & Magliaro, 1995, 1996), we had collected and stored data for each case, as well as conducted analysis with most of the data sources, although using different methodologies. These research efforts can be regarded as interim analyses in which we became familiar with studying teaching and learning products, developing procedures in recording observations and personal conferences, as well as retaining and analyzing documents. Over the six cases, we came to better understand the instructional setting, being sensitive to research opportunities and becoming more systematic in our data collection and management efforts, but also retaining instruction and responsiveness to learners as our top priority.

### **Developmental Research Guidelines**

From this study we have become more aware of how designing/teaching can be informed by adherence to research tenets, as well as more trustworthy results that can be obtained by structuring teaching decisions and learning artifacts as data sources. The following guidelines for conducting developmental research are organized along the developmental research cycle, consisting of design, implementation, and evaluation components (see Figure 3) and are listed first by teaching decisions and in the second column by developmental research prompts. The guidelines address both designing and teaching, activities customarily viewed as separate, but are viewed by us as complementary. Design requires the involvement of practitioners who bring insight into practical implementation problems, and our belief that designer and teacher can be one and the same.

#### ***Design Guidelines***

A major teaching decision is determining the purpose of the instructional intervention, through the use of course goals. A complementary developmental research prompt is being clear as to the purpose of the research. By answering the question, "What is this study about?" an appropriate methodology to study the research question(s) can be formulated. Developmental research objectives help to understand the complex phenomena at play in any educational intervention, so as to provide initial descriptive data for subsequent research questions.

Design and teacher thinking can be made explicit by recording design conversations and decisions from notes, lesson plans, unit plans, curriculum guides, or syllabi. A more comprehensive representation of one's teaching can be documented in an instructional framework, using the conceptual approach of Joyce, Weil, and Calhoun (2000). The instructional framework records the theoretical learning foundation of the different teaching approaches,



describes the social and support systems of the approaches, specifies syntax or procedural guidelines of to implement the approaches, and the instructional and nurturant effects of the teaching.

Another set of design/teaching decisions is to think through the activity roles of the teacher and the student and to identify the purpose of the activities, determine if the activities are developmentally appropriate, and sequenced appropriately. Thus, one can examine the alignment between desired learning outcomes, teaching options, and assessment. Developmental research prompts here would retain copies of learning activities and tasks so as to provide evidence of how these data sources evolved over time to support teaching adjustments.

### ***Implementation Guidelines***

Implementation guidelines for teachers involve ongoing evaluation of one's design/teaching decisions and dynamic adjustments needed during the intervention to address the desired learning outcomes. From a developmental research point of view, these design and/or teaching adjustments need to be recorded so as to provide a clear description of what occurred. Also, any changes in activities or tasks need to be documented to provide a description of how these data sources evolve over time.

It is possible during implementation that other forms of learning may be occurring. A research prompt can be useful to continue looking for phenomena that may be occurring but not addressed through a methodology or that emerges as a result of what occurs from the intervention or from "looking at classrooms" in new methodological approaches. Each school year or course delivery provides a unique set of learners and learning characteristics that must be analyzed in developmental research as a unique case.

During implementation teachers remain conscious of student perceptions to their teaching and the tasks and activities provided for them, as well as ongoing assessment of the ways in which students are learning or not learning. Are the assessment methods providing this information? Developmental research prompts here include habitual analysis of ongoing assessment, whether observations, interviews, or learning artifacts. In addition, the development of instruments to periodically assess student perceptions provides a new data source for implementation analysis and teaching adjustments.

### ***Evaluation Guidelines***

Evaluation guidelines primarily involve the examination of student performance on learning tasks and feedback on teaching efforts. Developmental research requires data sources that reveal student learning in terms of learning outcomes, as well as student or peer perceptions on teaching. Multiple forms of data from student activities (process and product forms) provide triangulating evidence of student learning. A challenge here is to maintain systematic data collection and management procedures in light of busy school schedules.

A secondary set of evaluation guidelines encourages designers/teachers to solicit feedback and advice from peers and other sources. Developmental research prompts teachers to collaborate on teacher studies and to disseminate findings.

Designing/Teaching Decisions	Developmental Research Prompts
<b>DESIGN</b>	
What is to be learned in this intervention?	What is the purpose of the study? Be explicit about how teaching will be studied through research objectives
Make explicit teacher thinking. Determine if there is an alignment between learning outcomes, teaching strategy, and assessment.	Record and store design decisions from conversations, notes, or lesson plans, syllabi. Document instructional framework, including theoretical foundation of teaching (Joyce, Weil & Calhoun, 2000)
Identify and describe teacher and student activity.	Examine teacher and student activity as data through reflective and performance artifacts. Retain copies of learning tasks.
<b>IMPLEMENTATION</b>	
Continually evaluate appropriateness of design decisions to learning outcomes. Document teaching activities and adjustments.	Document changes in data sources as they evolve over time to address research objectives.
What other forms of learning are occurring or not occurring? (incidental learning)	Document direct (learning goals) and indirect (nurturant) effects of instruction (Joyce, Weil & Calhoun, 2000).

Determine learning characteristics of students.	Each course delivery analyzed as a unique case.
Examine assessment criteria.	Are assessment criteria analyzable?
How are students learning and perceiving your instruction?	Develop instruments to obtain student learning and student perceptions.
EVALUATION	
Keep records on student performance.	Identify data sources that reveal student learning. Maintain systematic data management procedures.
Solicit feedback from students and listen to what they say.	Identify data sources for student perceptions of teaching. Maintain systematic data management procedures.
Seek out feedback from peers, develop teaching repertoire.	Collaborate on research into one's teaching, disseminate findings.

Figure 3. Designing/teaching and developmental research guidelines.

## Implications

The downsides of research for designers-teachers have been characterized by van den Akker (1999) as answers that are frequently too narrow, too superficial, or too late to do any good. Developmental research aims to address these issues of meaningfulness, generalizability, and usefulness. Developmental research can be used to assist designers and teachers in the development of educational interventions, while providing a systematic means to study their implementation. As all interventions are influenced by multiple stakeholders and are contextually -rich in nature, developmental research provides a dynamic vantage point for collaborators to talk about their roles, whether these roles be pragmatic (design, teaching) or knowledge-building (research). Developmental research also provides a framework to study instructional problems and responses, particularly as changes in the methodological framework may be required to adapt to evolving response prototypes.

Reeves (2000) provides several heuristics for developmental research activities, including the need to focus on difficult learning problems; align designs with learning outcomes, teaching, and assessment; collaborate and share with others; and the hard work needed for any developmental research project. Another critical heuristic suggested by Reeves involves identifying the theoretical and practical design principles that underlie a prototype and conduct rigorous studies of these principles in real settings. Carroll (2000) reminds us that viewing design as inquiry "raises the question of what abstractions can support the development and sense of knowledge in design" (p. 65). In particular, we raise to ourselves and others two challenges; namely, (a) the difficulty of abstracting principles or frameworks to help us in designing contextually -rich learning environments, and (b) acknowledging in developmental research the naturalistic nature of teacher knowledge. Both of these challenges resonate with the twin purposes of developmental research raised at the beginning of this paper: (a) formulating what we learn from our design efforts and (b) developing responsive educational interventions.

## References

- Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning sciences*, 2, 141-178.
- Brown, J., Collins, A., & Duguid, P. (1989, January-February). Situated cognition and the culture of learning. *Educational Researcher*, 18(1), 32-42.
- Bruner, J. (1990). *Acts of meaning*. Cambridge, MA: Harvard University Press.
- Carney, T. F. (1990). *Collaborative inquiry methodology*. Windsor, Ontario: University of Windsor, Division for Instructional Development.
- Carroll, J. M. (2000). *Making use: Scenario-based design of human-computer interactions*. Cambridge, MA: MIT Press.
- Duffy, T. M., & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In D. H. Jonassen (Ed.) *Handbook of research for educational communications and technology* (pp. 170-198). New York: Macmillan.
- Fosnot, C. T. (1996). *Constructivism: Theory, perspectives, and practice*. New York: Teachers College Press.
- Huberman, A. H., & Miles, M. B. (1998). Data management and analysis methods. In N. Denzin, Y. Lincoln (Eds.), *Collecting and interpreting qualitative materials* (pp. 179-210). Thousand Oaks, CA: Sage.
- Joyce, B., Weil, M., & Calhoun, E. (2000). *Models of teaching* (6<sup>th</sup> ed.). Boston, MA: Allyn and Bacon.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.

- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2<sup>nd</sup> ed.). Thousand Oaks, CA: Sage.
- Newman, D. (1990). Opportunities for research on the organizational impact of school computers. *Educational Researcher*, 19(3), 8-13.
- Norman, D. A. (1993). *Things that make us smart: Defending human attributes in the age of the machine*. Reading, MA: Addison-Wesley.
- Spradley (1980). *Participant observation*. Fort Worth, TX: Harcourt Brace Jovanovich.
- Reeves, T. C. (2000). *Enhancing the worth of instructional technology research through "design experiments" and other developmental research strategies*. Paper presented at the 2000 American Educational Research Association annual meeting. New Orleans.
- Richey, R. C., & Nelson, W. A. (1996). Developmental research. In D. H. Jonassen (Ed.) *Handbook of research for educational communications and technology* (pp. 1213-1245). New York: Macmillan.
- Schön, D. A. (1987). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*. San Francisco, CA: Jossey-Bass.
- Shambaugh, R. N., & Magliaro, S. G. (1995). *Teaching instructional design as a reflective process; A structured framework for promoting infinite play*. Paper presented at the annual meeting of the American Educational Research Association. San Francisco, CA.
- Shambaugh, R. N., & Magliaro, S. G. (1996, February). *Case studies on the development of formal design expertise*. Paper presented at the annual meeting of the Eastern Educational Research Association Conference. Boston, MA.
- Shambaugh, R. N., & Magliaro, S. G. (2001). A reflexive model for teaching instructional design. *Educational Technology Research & Development*, 49(2), 69-92.
- Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15(2), 4-14.
- Tharp, R. G., & Gallimore, R. (1988). *Rousing minds to life: Teaching, learning, and schooling in social context*. Cambridge: Cambridge University Press.
- van den Akker, J. (1999). Principles and methods of development research. In J. van den Akker, R. Branch, K. Gustafson, N. Nieveen & T. Plomp (Eds.). *Design approaches and tools in education and training*. Boston, MA: Kluwer.
- Wolcott, H. F. (1992). Posturing in qualitative inquiry. In D. D. LeCompte, W. L. Millroy, & J. Preissle (Eds.), *The handbook of qualitative research in education* (pp. 3-52). New York: Academic Press.
- Yin, R. K. (1994). *Case study research: Design and methods* (2<sup>nd</sup> ed.). Thousand Oaks, CA: Sage.

# Leadership in Higher Education: Instructional Designers in Faculty Development Programs

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## Abstract

*Instructional designers are well equipped to handle the leadership of faculty development in higher education. Faculty development is part of the process of lifelong learning for the college or university instructor and a key component of the transformational changes taking place in higher education. The need for faculty to appropriately integrate technology into their curriculum and utilize innovative instructional methodologies is driven by five factors: students, faculty, administration, society, and technology. The role of instructional designers and instructional systems design methodologies are critical to the success of faculty development programs and can successfully facilitate the dynamic change process currently underway in colleges and universities.*

*Faculty development in higher education is a part of the process of lifelong learning for the college or university instructor and a key component of the transformational changes taking place in higher education. Five factors are driving the need for faculty to appropriately integrate technology and instructional systems approaches into the design and development of their courses: students, faculty, administration, society, and technology. A skilled instructional designer is a well-trained professional for assisting faculty members and serving faculty development programs to better utilize innovative instructional methodologies, strategies, and techniques. The anticipated outcome of the current transformation in higher education is improvement in teaching facilitated by faculty development initiatives under the guidance of the instructional designer.*

## The Transformation of Higher Education

Change is happening within many sectors that have direct influence on colleges and universities and the effects are certain to alter the way in which higher education operates in the future. Managing the transformation is the key to survival for colleges and universities. Understanding the forces of change requires leadership that is skilled in evaluating and synthesizing the inter-relatedness of the variables involved. Technology, as an innovation, consistently creates changes in the way people and organizations function, access information, and communicate. The transformation of higher education can be understood in terms of the forces that are driving the need for faculty development. The changing student character is creating the need for faculty to adopt new teaching strategies. The need of faculty and administration to accomplish their respective functions drives the need for and enables the establishment of faculty development programs. The changes in the demographics, culture, and nature of work in society are reflected in the expectations of graduates. The application of technology to educational objectives creates an evolving, dynamic environment for learning, and subsequently requires an improved, dynamic methodology of teaching. Based on their knowledge of systems theory and change management, instructional designers can serve as change agents within faculty development programs.

## Role of Faculty Development in the Transformation of Higher Education

Faculty development is a process of professional training (and retraining) undertaken by instructors in higher education. Like its corporate counterpart, faculty training and development is important for maintaining or improving the quality of services and products offered by the organization. Highly skilled faculty is the core of a top quality academic institution and is the primary producers of critical higher education products: prized research and educated graduates.

A working definition of faculty development will help clarify this topic and show the far-reaching boundaries that support its role as a catalyst for transforming higher education. Faculty in colleges and universities are undertaking fundamental remodeling of their teaching approaches. Duderstadt (1999) believes that faculty in higher education will require new instructional methods, models, and techniques for serving the learning needs of the future generation and that faculty development initiatives are instrumental in guiding the transformation. Typically, the literature addresses faculty development only in terms of integrating technology into the teaching and

learning experience. While technology should play an important role, it remains a mere tool to support fundamentally good educational practice.

Faculty development can also be viewed as a process of careful identification of past teaching successes and the generation of ideas, beliefs, and convictions about teaching and learning. From these beliefs it is then possible to choose among the many new tools, technologies, and instructional strategies available. Faculty development programs are focused on the integration of educational technology tools, such as, the Web, hardware, software, and the appropriate use of audio-visual equipment, into a faculty member's established teaching practices. Instructional strategies and methodologies include the instructional systems theories, models, and strategies for analyzing, designing, developing, implementing, and evaluating educational experiences and outcomes.

Faculty development is for the purpose of improving teaching and learning at undergraduate and graduate levels. American colleges and universities have been making numerous efforts to improve teaching and learning on their campuses since the 1980s. As a result, some changes have occurred and the repertoire of teaching practices has expanded, such as greater student involvement through collaborative and cooperative learning; technology-based learning; learning communities to bring faculty and students closer together; and teaching centers to improve practice. Despite the various pedagogical innovations there has not been enough deeper reform. There is little evidence that the changes amount to a real systemic reconsideration of how and why students learn or of how institutions, not just faculty, can revise their approaches to teaching (Lazerson, Wagener, & Shumanis, 2000).

### **Rationale for Faculty Development**

Why is there a need for faculty development? A few reasons for undertaking faculty development initiatives emerged from the literature. The primary reason is to help faculty to move their teaching, research, and service forward, which are the three parts of the higher education mission. The goal of improving skills and techniques is equivalent to innovating, which is required for continuing to meet the needs of the stakeholders in higher education, namely students who enroll for the purpose of learning. In most cases, faculty in higher education are paid for teaching but rewarded for scholarship. Further, most faculty are not trained in instructional design and methodologies, as are graduates of teacher education programs (Noone & Swenson, 2001). They learned how to teach by the example set for them by their instructors and then perhaps modified those practices based on actual classroom experience. As research on effective teaching and learning methodologies moves forward, adoption of the best practices by faculty must move with it. Instructional technology practitioners help the internal processes of faculty development by providing the necessary training and support for both pedagogical and technological issues.

Faculty development initiatives have cross-interaction effects with five key areas of the college and university: student acceptance, administrative policy, faculty adoption, technology integration, and the societal context in which the institution functions. Addressing the needs for faculty development has a significant holistic impact on the institution and can act as an energizing catalyst for the systemic change and transformation of higher education. The instructional designer operating within higher education should develop an understanding of this dynamic interaction for the improvement of faculty development initiatives.

#### ***Driving Factor: Students***

Today's students are more wired, technologically savvy, and connected than any previous generation their character has been shaped by a fast-food style, digital revolution of media and near instant access to information, has little desire for the traditional modes of teacher-centered classroom instruction. Their desires for technology-enhanced experiences are not limited to personal use. Students' expectations for technology-enhanced, practical, collaborative, real-world learning environments contrast with the majority of faculty who still depend on lectures as their prime teaching method (Hansen & Stephens, 2000; Noone & Swenson, 2001). Students are the consumers of the higher education institution's products. If teachers continue to teach in the same way that they have always taught, they will lose the interest of this digital generation and miss the mark of helping to educate, and thereby transform, today's diverse students. Frand (2000) suggests higher education needs to account for the new attitudes and beliefs of students and transform the educational experience so that it is meaningful to the information-age learner. Given an increasing awareness of duty to undergraduate students, colleges and universities, particularly research universities, are engaging in lively debate on how much attention should be paid to undergraduate education (Kennedy, 1998).

#### ***Driving Factor: Faculty***

Forces of change are most productive when they originate from within the entity that needs changing. Faculty is a key subset of an institution's administrative body, and may be considered the most significant driving factor affecting faculty development. The opportunity for facilitating the change through faculty development programs is one that faculty have begun to take advantage of, but not in such a manner as to have the intended effect. Lazerson et al. (2000) report "...efforts to improve teaching and learning have been supported only in part by faculty and institutions as a whole, with results that are neither significant nor pervasive." When faculty perceive there is a need to change and they understand the true benefit of change to their professional development, there will be a tremendous shift towards faculty development. According to Brown (2000), the shift is occurring now. Scholars worldwide are creating a storm of educational technology experiments. As they assemble in conferences, hallways, and special panels, they are seeking to engage in the issues and opportunities arising from technology-enhanced learning. Faculty seem to be undertaking fundamental remodeling of their teaching approaches and giving a thoughtful consideration of pedagogy. Even though professional development for faculty is important, it is not enough to ensure support for and adoption of technology for teaching. It is a mistake to frame the issue as one of training faculty, which tends to put the "blame" on faculty members and implies that they are the problem that needs to be fixed. Professional development is the last stage in a broader, holistic change process (Bates, 1999). Given the proper conditions of creative energy and institutional loyalty, the faculty is willing to experiment and to engage actively with the needs of students (Kennedy, 1998). In response, faculty members are asking for help from their administrations and one another.

### ***Driving Factor: Administration***

The holistic change process is in large part, the purview of the administration. The administrative function of colleges and universities is a driving force on faculty development by virtue of their responsibility for setting policy, managing financial and capital resources, and ensuring the ongoing vitality of the institution. The administration knows that faculty is the key source of a healthy environment, but they must also take action for altering the current atmosphere to invite change. Transformational change powered by the technological revolution is constrained when mistakenly held within the context of the old organizational structures. This is the "mirage of continuity" that denies the need for reorganization of financial and management systems. Outmoded administrative units falsely believe the historic tradition of knowledge creation and transmission can be transformed by the simple substitution of digital for analog technology. A new conception of the university is needed (Battin & Hawkins, 1998).

Policy should precede and guide action. Kennedy (1998) suggests that in order for the transformation of a college or university to occur, institutions require new methods of making faculty members feel responsible for the institution and for its students. One suggested way is to develop a more centralized sense of direction, while at the same time, maintaining a shared governance structure in which faculty members feel more like stakeholders. To help this process, institutions must be more flexible and responsive to new needs, trends, and opportunities, by setting aside funds for new initiatives and perhaps most importantly, by cultivating the spirit of innovation.

Action follows and supports policy. The adoption of academic technologies is a strategic imperative for higher education. The first step in the process of reinventing instructional technology is to convert it into a strategic tool tightly incorporated in well-defined and well-researched institutional objectives. Most every college and university mission statement lists "quality teaching and learning" as one of its key strategic objectives, but have not adequately defined the meaning of "quality learning" with respect to new workplace skills and individual student needs or associated the criteria to particular instructional technology strategies that can be used to achieve them (Privateer, 1999).

### ***Driving Factor: Society***

Faculty development, as the primary catalyst for change in two core areas of the university—teaching and learning—is positioned to lead the transformation of the university to meet the needs of the 21st century society dominated by electronic technology (Battin & Hawkins, 1998). Society provides the context in which higher education institutions exist and ultimately serves. The relationship is symbiotic—society produces the students who matriculate and then graduate with some increased capacity to productively serve society. Kennedy (1998) observes that society is paying attention to higher education as evident by media reports of academic scandal, research misconduct, and athletic scholarship violations, as well as more thoughtful and private criticism of employers, government leaders, and parents. It can be said that some attention, even negative, is a sign that Americans care about colleges and universities.

Society perceives higher education as the archivists of cultural heritage and conservators of its history for the purpose of passing both on to subsequent generations of students. It is in the best interest of society that colleges and universities are effectively fulfilling these responsibilities (Kennedy, 1998). These expectations of a changing society on higher education have implications for how teaching and learning is carried out. Employers are a primary stakeholder in society and are looking for graduates who are problem-solvers, which require higher order thinking skills and good collaboration skills. In addition, the changing nature of society—characterized by eras of economic shifts from industrial to information to knowledge—places pressure on colleges and universities to improve the information intelligence of its graduates. The establishment of information science departments within universities in recent years evidences this trend. Faculty will require new skills for delivering, monitoring, and assessing the types of instruction that encourage the maturation of higher cognitive functions and better collaboration skills in students.

### ***Driving Factor: Technology***

Technology advancements both drive and support faculty development initiatives. Technology is in constant change. Each advancement or application to education opens new possibilities for its adoption and diffusion in the teaching and learning enterprise. Faculty should seek professional development to better understand and possibly integrate technology into their practice. Like a high-speed train, technology is a rapid transportation vehicle to new levels of learner knowledge construction. Faculty must choose to ride the train, step off, or at least, move out of the way. Given the risk and potential reward of integrating technology into an existing academic paradigm, much more time and research will be needed before a set of “best practices” for the use of new technologies in higher education can be determined. Meanwhile, change is happening at a rate not seen in higher education for a long time. In most colleges and universities, innovation has historically been descriptive of research and scholarship, not teaching methods. The new digital technologies now make bold and creative educational experimentation possible (Farrington, 1999). With each new telecommunication innovation, the basic nature of learning and teaching is changing and creating new ways to process and disseminate information. Instructional technology leaders must be a part of the decision making process when telecommunications and computing technologies are determined (Withrow, 1994).

### **The Role of Instructional Technology and Instructional Designers**

By its innovative nature, instructional technology creates a dynamic for change wherever it is properly used. In particular, computer and telecommunication technologies forces institutions and individuals to adapt to the revolutionary ways in which data and information are stored, retrieved, and communicated. The traditional tasks of editorial criticism and evaluation of course assignments can now take place electronically and, in the best circumstances, link professor and students more closely for more of the work than ever before. Instructional technology facilitates the effective design process of innovative learning environments through the use of efficient systematic methodologies and strategies.

It is a positive note for the instructional technology field that instructional designers are increasingly appearing on the payrolls of universities, namely in faculty development and support programs. Surry (1996) reports that instructional designers are steadily being hired in higher education and in a more recent study, Surry and Robinson (2001) categorized hundreds of educational technology job postings. The instructional design leaders who fill these positions will need to have supplemental skills, such as project management and facilitating change to complement their ISD skills. Their backgrounds and experiences, more than any other professional field, qualify them to handle the dynamic nature of change in educational technology and its application to learning processes and teaching strategies.

As the transformation progresses, faculty will continue to need training and refreshers in the skills that are essential for teaching and learning with technology; support during the development process; and advice for the effective integration of media and information technologies. Instructional technology practitioners need to be prepared for these challenges. Duderstadt (1999) said so well, “The real question is not whether higher education will be transformed but rather *how* and *by whom*.” Instructional designers are the professionals prepared to be involved in the transformation and should seek leadership positions in order to positively affect organizational change during the transformation. In addition, it will become incumbent upon them to make contributions to the instructional technology knowledge base regarding research, instruction, process, and outcomes of faculty development initiatives.

## Conclusion

To secure future viability and fulfill its tripartite mission of teaching, research, and service, higher education must choose a better strategic path. If they want to reinvent themselves, they have to take a long and hard strategic look into how their delivery of instruction conflicts with the cognitive potentials of contemporary information technologies. Instructional designers are uniquely qualified to take on significant leadership roles within higher education to manage faculty development programs. Faculty development is a component of the process of lifelong learning for professors and educators in higher education and a key component of managing the transformational changes taking place in higher education over the next decade. The key concept of faculty development as a transforming agent of colleges and universities is accepting, understanding, and managing the dynamic changes brought about by the five external and internal factors: students, faculty, administration, society, and technology. These factors drive the need for faculty to integrate technology into their curriculum and utilize new instructional methodologies, strategies, and techniques.

Students' expectations for technology-enhanced, practical, collaborative learning environments contrast with the majority of faculty who still depend on lectures as their prime teaching method (Hansen & Stephens, 2000). If teachers continue to teach in the same way that they have always taught, they will miss the mark of helping to educate (transform) today's diverse students and make the educational experience meaningful to the information-age learner (Frاند, 2000).

The opportunity for facilitating the change through faculty development programs is one that faculties have begun to take, but with modest results that are neither significant nor pervasive (Lazerson, et al., 2000). When faculty perceives there is a need to change and they understand the true benefit of change to their professional development, there will be a tremendous shift towards faculty development. Even though professional development for faculty is important, it is not enough to ensure support for and adoption of technology for teaching. A holistic change is needed to support faculty adoption.

The holistic change process is primarily the leadership responsibility of the institution's administration. The administrative function of colleges and universities is a top-down, driving force on faculty development characterized by setting policy, managing financial and capital resources, and ensuring the ongoing vitality of the institution. The administration knows that faculty is the key source of a healthy environment, but they must also recognize the need to alter the current atmosphere to invite change. Transformational change should not be constrained within the context of the old organizational structures. Battin and Hawkins (1998) refer to this as the "mirage of continuity" that denies the need for reorganization of financial and management systems. Historic tradition of knowledge creation and transmission must be replaced with a new conception of the university.

The expectations of a changing society on higher education have implications for how teaching and learning is carried out. Employers are looking for graduates who are problem-solvers, which is challenging to teach in every discipline. Nevertheless, the changing economic nature of society places pressure on colleges and universities to improve the information intelligence of its graduates. Faculty will require new skills for delivering the types of instruction that encourage the maturation of higher cognitive functions and better collaboration skills in students.

Given the risk and potential reward of integrating technology into an existing academic paradigm, more research on the best uses of the new technologies is needed. New digital technologies allow for bold and creative educational experimentation. Instructional technology, by its innovative nature, facilitates change wherever it is appropriately used. To secure future viability and fulfill its mission of teaching, research, and service, higher education must choose a better strategic path. If they want to reinvent themselves, they have to take a long and hard strategic look into how their delivery of instruction conflicts with the cognitive potentials of contemporary information technologies. The key concept of faculty development as a transforming agent of colleges and universities is accepting, understanding, and managing the dynamic changes brought about by the five factors: students, faculty, administration, society, and technology.

The instructional designer is one of the best prepared education professionals to provide training in the skills that are essential for teaching and learning with technology, to provide support during the instructional development process, and to offer pedagogically sound guidance for the effective integration of media and information technologies. Instructional technology practitioners should seek leadership positions in faculty development programs. The result is likely to positively affect implementation of ISD practices, theories, and strategies into faculty development. The instructional designer is a versatile education professional that can offer valuable skills and facilitate appropriate use of instructional systems design for improving teaching and learning methodologies in faculty development programs. In this capacity, instructional designers can play a key leadership role in the transformation of higher education.



## References

- Bates, A. W. (1999). *Managing technological change: Strategies for college and university leaders*. San Francisco: Jossey-Bass Publishers.
- Battin, P. & Hawkins, B.L. (1998). "Setting the Stage: Evolution, Revolution or Collapse?" In: Hawkins, B.L. & Battin, P., (Ed.). *The mirage of continuity: Reconfiguring academic information resources for the 21<sup>st</sup> century*. Washington, D.C.: Council on Library and Information Resources, 3-12.
- Brown, D., (Ed.) (2000). *Interactive learning: Vignettes from America's most wired campuses*. Bolton, MA: Anker Publishing.
- Duderstadt, J. J. (1999). Can colleges and universities survive in the information age? In Katz, R. (ed.) *Dancing With the Devil: Information Technology and the New Competition in Higher Education*, Jossey-Bass, San Francisco, CA.
- Farrington, G.C. (1999). "The new technologies and the future of residential undergraduate education." In: Katz, R. and Associates. *Dancing with the devil: Information technology and the new competition in higher education*. San Francisco: Jossey-Bass, 73-94.
- Frand, J. (2000). "The Information-Age Mindset: Changes in Students and Implications for Higher Education." *EDUCAUSE Review*, 35(2), pp. 15-24.
- Hansen, E.J. & Stephens, J.A. (2000). "The ethics of learner-centered education." *Change* 33(5), 40-47.
- Kennedy, D. (1998). "To change." In: Hawkins, B.L. & Battin, P., (Ed.). *The Mirage of continuity: Reconfiguring academic information resources for the 21st century*. Washington, D.C.: Council on Library and Information Resources, 13-35.
- Lazerson, M., Wagener, U., & Shumanis, N. (2000). "What makes a revolution? Teaching and learning in higher education, 1980-2000." *Change* 32(3), 12-19.
- Noone, L.P. & Swenson, C. (2001). Five dirty little secrets in higher education. *EDUCAUSE Review*, 36(6), 20-31.
- Privateer, P.M. (1999). Academic technology and the future of higher education: Strategic paths taken and not taken. *The Journal of Higher Education*, 70(1), 60-79.
- Surry, D.W. (1996). Defining the roles of the instructional technologist in higher education. In *Proceedings of the 1996 Mid-South Instructional Technology Conference*, Middle Tennessee State University, Murfreesboro, TN. Accessed from the World Wide Web, 10/30/01, at <http://www.mtsu.edu/~itconf/papers96/it.html>.
- Surry, D.W. & Robinson, M.A. (2001). A Taxonomy of instructional technology service positions in Higher Education. *Innovations in Education and Teaching International*, 38(3), 231-238.
- Withrow, J.B. (1994). Educational leadership in an information-rich society. In: Kearsley, G. & Lynch, W., (Eds.). *Educational technology: Leadership perspectives*. Englewood Cliffs, NJ: Educational Technology Publications.

## Co-Inquiry Approach to Learning and Using Hypermedia

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### Abstract:

*This article analyzes the uses of various technologies to enhance literacy practices using a multi-genre writing project with pre-service teachers and middle school students. Twenty-seven English pre-service teachers, simultaneously enrolled in a methods and a technology course, collaborated with middle school students using asynchronous web discussion to develop hypermedia projects that fostered and promoted the use of technology as a tool. These tools mediated the uses of various literacy practices within the larger activity system of teacher education, whose object is to assist teachers to acquire those practices involved in working effectively with students. Qualitative data were collected through analyzing preservice teachers' development of Storyspace hypermedia projects, the use of asynchronous discussion with their middle school students, and participation on a WebCT bulletin-board discussion. The hypermedia productions with middle school students helped the preservice teachers learn how to model the literacy practices of making intertextual or hypertextual links. The web-based communication with students helped preservice teachers develop relationships with students in the absence of face-to-face interaction. And, through participation in the WebCT bulletin board, preservice teachers employed different literary practices ranging from the display of spontaneous thinking to engaging in word/role play.*

### Literacy Practices and Technology Tools

A preservice teacher and a middle-school student are exchanging messages on a web-based bulletin board about a biography project they are working on together on the topic of Princess Diana. The student posted the following message:

Last night I went on the Internet and found a lot of stuff like her will, and her divorce papers and some poems some people wrote about her. I also found some pictures of when she was younger.

The preservice teacher responded:

Last night I bought a couple of books about Princess Diana that were on sale at the bookstore. One contains a bunch of short little memories of her written by all sorts of people that knew her in her lifetime. I will also print at least 2 articles from the Internet that will be helpful (not too long) for us to think about what we want to write about.

See you Wednesday.

This on-line exchange was part of a project involving preservice English teachers working in a semester-long practicum experience with a group of middle-school students, a project that involved extensive uses of technology. Their on-line exchange entails uses of literacy practices such as sharing information and planning activities, practices central to a co-inquiry writing project. This project represents the increasing use of technology as a tool for linking adults with students in schools, an approach that is highly relevant to teacher education.

In many teacher education programs, in addition to their student teaching, preservice teachers are required to complete practicum experiences that involve minimal face-to-face interaction with students. Technology can enhance preservice teachers' interaction with students, as well as providing students with positive learning experiences through technology. For example, in the "Fifth Dimension" after-school computer-mediated program operated by the University of California, San Diego, participation in an elaborate set of computer games and activities resulted in increased student engagement, participation, and learning within a community (Cole, 1999). In this program, University undergraduates serve as "Wizards" who guide students through a "maze" of activities based on the students' zone of proximal development.

Educators are also employing web-based tools to foster on-line discussions between teachers regarding issues faced in their programs or in the classroom. The Inquiry Page housed at the University of Illinois <<http://inquiry.uiuc.edu/>> is designed to help teachers share teaching successes and collective expertise (Bruce & Davidson, 1996; Bruce & Easley, 2000). Teachers engage in mutual inquiry through their access to resources on teaching and learning, articles, project links, curriculum units, and content resources. Users of the site are themselves the developers who reconstruct the tool as they use it. Participants may also share video, photos,

graphics, texts showing people engaged in inquiry in different settings and access resources involving a dynamic incorporation (using Digital Windmill) of the Open Directory category on Inquiry Based Learning.

This site represents new generation of web design that serves the social needs of teachers to mutually engage them in co-inquiry about problems, issues, or dilemmas. Research on uses of these sites indicates the importance of quality of the social interaction in this on-line co-inquiry. For example, Barah and Schatz (2001) analyzed the development of a web-based learning site designed to foster sharing of inquiry-instruction ideas by Indiana math and science teachers in terms of the components of evolving activity systems. This web site was initially designed as a tool by University educators to achieve the object of more discussion/sharing about inquiry instruction with the outcome being improved understanding of inquiry-based instruction. However, given the lack of participation, the University educators, along with teacher participants, shifted the focus of the web site to emphasize participants' mutual collaboration at the site around inquiry-based math/science instruction.

In this report, we examine the various literacy practices that were fostered through the uses of technology tools that included web-based bulletin-board exchanges and hypermedia productions. We hope to demonstrate that technology tools can serve to mediate and foster the development of a range of different literacy practices within a teacher education program.

### **Technology Tools as Mediating Literacy Practices**

Social-cultural activity theory of learning (Cole, 1996; Engestrom, 1987; Wertsch, 1998) posits that learning occurs through social uses of various tools—language, signs, images, texts, as well as technology tools. Activity theorists believe that people learn the uses of these tools by learning how they are linked to the objects or outcomes driving a specific activity within an “activity system.” Russell (1997) defined an activity system as: “any ongoing, object-directed, historically conditioned, dialectically structured, tool-mediated human interaction. Some examples are a family, a religious organization, a school, a discipline, a research laboratory, and a profession” (p. 510).

Central to activity theory of learning is the idea that these tools function to mediate learning of literacy practices (Bruce & Levin, 1997). Students learn to use a range of tools to engage in these literacy practices. Work in the field of “distributed cognition” (Hutchins, 1993) posits that certain practices associated with an activity become embodied or “distributed” in tools. For example, navigational instruments are used to capture what is known about navigating the seas. They then serve as tools that guide a ship based on human knowledge about navigation. Similarly, expert computer systems are built on experts' knowledge about a certain phenomena such as diagnosing a particular disease. Tools are therefore used within an activity to function as extensions of certain practices involved in an activity (Vygotsky, 1978). We turn now to discuss examples of how learning the following literacy practices are mediated through technology tools:

*Defining intertextual connections.* One basic literacy practice involves defining intertextual links between texts. In defining intertextual links, people define connections between texts in terms of similar images, characters, topics, or themes. Roland Barthes (1970) argues that “Every text, being itself the intertext of another text, belongs to the intertextual...the quotations from which a text is constructed are anonymous, irrecoverable, as yet *already read*” (p. 443).

Students are engaged in making intertextual links in through multi-genre writing about a topic, an approach currently popular in secondary writing instruction (Romano, 2000). Multi-genre writing involves using a range of different types of genres—reports, poems, letters, diaries, stories, advertisements, field notes, photos, drawings, etc. to explore different aspects of and perspectives on a topic. Connecting these disparate genre types requires the ability to determine how different types of texts yield different perspectives on the same topic or phenomenon.

One technology tool that mediates the practice of making intertextual links is hypermedia. Hypermedia functions as a tool by combining hypertext (texts linked together by multi-linear nodes) and multimedia (photos, video, art, audio, text, etc.) to produce an interactive media experience for participants (Jonassen, 2000; Landow, 1997). Because hypertext allows participants to choose optional paths through multimedia, participants can both construct and respond to hypermedia interactively. Students often respond positively to hypermedia texts because it is consistent with their everyday experiences with multi-modal environments that combine images, animation, video, music, and texts (Myers & Beach, 2001).

In an essay about the pedagogical implications of this shift towards hypermedia, Jay Bolter (1998) argues that hypermedia challenges the traditional emphasis in literacy instruction on understanding or producing unified, coherent texts based on a definitive, single perspective. He calls for an alternative focus on teaching a “rhetoric of expectations and arrivals” (p. 10) that help students understand where certain links may take them and how they should respond to where they arrive. And, given the important role of graphic representations in hypermedia, he

posits the need for often-marginalized art and video-production instruction to help students respond critically to images.

Producing hypermedia texts using tools such as Storyspace™, HyperStudio™, HyperCard™, and various web authoring programs, involves defining intertextual links between a range of different types or genres of texts (McKillop & Myers, 1999; Myers, Hammett & McKillop, 1998; 2000). For example, high school students represented their experiences with peers through combining photos, music, video clips, and texts to interpret short stories (Beach & Myers, 2001; <http://www.ed.psu.edu/k-12/socialworlds/>).

Hypermedia can also assist in organizing links around central themes or topics in writing instruction. Analysis of first-year college writing class students' construction of hypertexts indicated that students structured information around central ideas and illustrated that idea through links to other texts or graphics (Duguay, 1999). Using the hypertext as a tool, helped students define links between diverse parts of their hypertext because the links made it visually easier to connect the ideas.

Researchers have also examined the nature and types of links constructed in hypermedia production, as well as the social motivation to construct these links within the classroom as an activity system. In one study, 16 seventh graders 18 preservice teachers used StorySpace™ to combine original poems, images, and QuickTime movies to explain the various literacy devices used in poetry (McKillop & Myers, 1999). The types of links employed in the hypermedia productions were analyzed in terms of their functions—an “iconic function” was used to illustrate another text, an “indexical function” was used to extend a text to show shared meaning, and a “symbolic function” was used to question the meaning of a text which resulted in a greater understanding of or a critical analysis of a text. Most of the seventh graders' links served as iconic illustrations of ideas in poems. There were far fewer instances of links reflecting critical analysis, for example, when students juxtaposed texts to generate contested meanings. The undergraduates were more likely to employ links serving a “symbolic function” that involved critical analysis of texts. This study suggests that users employ links for different purposes representing different levels of critical thinking.

Ryan (1999) examined in college students' construction of hypermedia links using HyperCard™ to write a “Literary Journal” biography of an American author based on a range of different sources and information about that author's life, as well as comments on other students' work and supplementary material. In contrast to the essay format that often constrains exploration of alternative, conflicting perspectives, the hypertext format fostered exploration of alternative, conflicted perspectives about an author's life that resisted closure.

Nancy Patterson's (Patterson, 2000) middle school students at Portland Middle School, Portland, Michigan, used Storyspace™ to construct hypertexts based on research on American history and culture (<http://angelfire.com/mi/patter/america.html>). Students created hypertext narratives with links to information about slavery. As Patterson notes (<http://www.npatterson.net/mid.html>), working with Storyspace™ shifted students away from simply rehashing information about persons to understanding people and events as shaped by historical and cultural forces.

*Posing questions.* Another literacy practice involves posing questions related to exploration of issues, topics, concerns, or dilemmas (Beach & Myers, 2001; Short & Harste, 1996; Smithson & Dias, 1996). In teacher/students journal dialogue exchange, teachers pose questions designed to encourage students to elaborate on their answers or explore other perspectives, modeling heuristics for exploring topics. Overtime, students internalize these questions and employ them in their own writing, resulting in increased elaboration in their writing (Peyton & Staton, 1993). Computer-mediated written communication between teacher and student can serve as a tool for teachers to engage in similar dialogue-journal writing modeling of question-asking (Beach & Lundell, 1998).

*Adopting multiple voices and perspectives.* Another basic literacy practice involves adopting multiple voices and perspectives through making “double-voice” intertextual references or evoking or mimicking the languages or styles from other texts or worlds (Bakhtin, 1981; Knoeller, 1998). Speakers and writers employ these intertextual references to establish social relationships and identities (Bloome & Egan-Robertson, 1993). Through interaction with others, participants construct identities by performing in ways that position them in relation to others' positions--“it is in the connection to another's response that a performance takes shape” (McNamee, 1996, p. 150). As Bakhtin (1981) argued in his concept of “answerability,” people's utterances reflect their relationships with others' potential, anticipated reactions to their utterances. In participating with a range of diverse perspectives and voices in a computer-mediated context, students learn to consider alternative perspectives different from their own (Taylor, 1992). The more open students are to experimenting with alternative ways of being and knowing, the more open they are to entertaining alternative values, as opposed to a rigid, monologic perspective on the world (Lewis & Fabos, 1999).

*Adopting a collaborative, inquiry stance.* In conducting discussions with students, teachers attempt to adopt a collaborative, exploratory stance that serves to invite mutual exploration with students. Adopting this stance requires teachers to balance their status as authority figure with the need to establish a relationship with students. As Deborah Tannen (1984) notes, in this negotiation, participants may use conversation as “symmetrical”-to maintain equal status, or, as “asymmetrical”--to establish a dominant/subordinate relationship. On-line discussions serve to minimize some of the nonverbal aspects creating “asymmetrical” status differences in face-to-face interactions (Walther, 1996). Differences in uses of “asymmetrical” practices may also be related to gender stances. Analysis of college classroom discussions indicated that females were more likely to employ “task-continuative” practices comprised of questions and answers, validation of others’ comments, back-channel comments, repetition, extension, supportive laughter, extended development or talk than were males (Bergvall & Remlinger, 1996).

The ability to adopt collaborative, exploratory stance depends on participants’ willingness to be open to entertaining others’ beliefs as valid and rational, something that what Donald Davidson (1984) refers to as the “principle of charity” (p. 126). As Porter (2001) notes, “because communicators cannot assume shared meanings..., they must assume a shared world; if they assume that they share neither a language nor a world, there would be no possibility for communication” (p. 586). It also requires the ability to frame statements of beliefs or opinions as tentative hunches or hypotheses—what Davidson (1984) refers to as “passing theories” (p. 45). The concept of “passing theories” refers to the idea that participants are willing to modify their established “prior theories” to be open to entertaining and integrating others’ beliefs into one’s own beliefs (Dasenbrook, 2000). In classroom discussions of literature, when students framed a new topic in a tentative, exploratory manner, other students were more likely to follow up on that topic than when the topic was framed in a definitive manner (Beach & Phinney, 1998). Synchronous computer-mediated classroom interaction in a seventh-grade classroom served to foster students’ mutual exploration of tentative ideas and perspectives because they were simultaneously brainstorming together in the same chat site; adopting a hard-line stance was socially unacceptable in this exchange (Beach & Lundell, 1998).

This research indicates that a range of different literacy practices can be fostered through uses of technology tools. This raises the question as to whether technology tools can be used in a teacher education activity system whose object is to foster preservice teachers’ ability to acquire and teacher these literacy practices.

### **Preservice English Teachers’ Participation in a Co-Inquiry Multi-Genre Writing Project**

This research project examined the question as to how one group of preservice teachers used technology tools to acquire various literacy practices involved in working with middle-school students in a multi-genre writing project.

The participants in this project were 27 preservice English teachers enrolled in a composition-methods course taught by Beach and an instructional technology course taught by Doering in the Fall Semester, 2000 at the University of Minnesota. Preservice teachers [hereafter “teachers”] in the composition methods course learned various strategies for engaging in inquiry-projects and for teaching multi-genre writing. The purpose of the instructional technology course was to help teachers acquire a set of technology tools they could employ in teaching English.

In conjunction with these courses, participants were engaged in a semester-long practicum experience in a magnet middle school that draws students from a wide range of both urban and suburban districts in the St. Paul, Minnesota area. The school curriculum is organized around interdisciplinary inquiry projects in which students are engaged in constructivist exploration of topics across different subjects. The students represented a wide range of socio-economic backgrounds and ability levels, with many students testing at a relatively low reading level. The teachers each worked during weekly visits with one or two students in each of two different class periods.

*A multi-genre writing project.* The teachers and middle-school students worked together on a multi-genre project involving writing a biographical sketch, a newspaper report, and a narrative about famous people ranging from Martin Luther King Jr. to Princess Diana. They conducted research about their person using the Web and other sources based on questions posed about the person, generating information they used to write a biographical sketch. Students then wrote a newspaper article about some aspect of or even in the person’s life employing ClarisWorks to create a news article format. The project concluded with students writing a fictional narrative about their person in which they adopted that person’s or another person’s first-person point of view to describe some event in the person’s life. This required students to imagine the person’s subjective experience in an event, along with descriptions of dialogue; setting; and the person’s feelings, attitudes, and beliefs about the event.

For the final presentations of their multi-genre projects, the students shared the results of their work in short ten-minute presentations in small groups. Students employed a range of multi-modal presentations acting out a scene from their lives, a skit, interview the person, a piece of art in the person's form; an overhead, slide presentation, news report/sportscast, and dramatic reading.

*Hypermedia production.* As part of their instructional technology class, the teachers created their own hypermedia production based on their students' multi-genre writing. They used Storyspace™ (Bolter, Smith, & Joyce, 1990) as a tool to develop and link multimedia material within windows that can include or be embedded in other hierarchical windows. (Given the lack of access to computers in the middle school, and the expense of the Storyspace™ software, the teachers, in discussion with their middle-school students, developed the hypermedia versions of the multi-genre writing at their University site. In an ideal situation, the teachers and the students would have developed the hypermedia at the middle-school site.)

Constructing the hypermedia production to share with their students involved a shift in role for the teachers from purveying knowledge to demonstrating their "knowledge by design" (Perkins, 1986). This change in learning when using hypermedia sometimes causes problems as learners struggle to integrate the information they are learning into a hypertext document (Jonassen, 2000). To explore their knowledge as related to their audience, they initially developed concept maps using Inspiration™ to represent their knowledge prior to creating the hypermedia production. These concept maps were used as guides to help the teachers choose what links they believed were important as well as what types of media they may want to employ (graphics, video, sounds) to represent their knowledge in StorySpace™

The hypermedia productions were analyzed by the investigators in terms of the types of texts—images, written texts, sounds, etc., teachers included in their productions, as well as the types of links they employed in connecting these texts.

*Web-based teacher/student communication.* As part of a federally funded technology-development program, an asynchronous Web-based teacher/student communication site was created to foster communication between the teachers and students during the time when they were not working with each other in school. To address potential security and privacy issues, pupils would click on the name of their assigned student and then engage in conversation about their projects or personal matters. Only the pupils assigned to the teachers could access those particular teachers. Because the communications were asynchronous, teachers and the middle school students could post and respond to questions relating to their cooperation on the project at any time.

Transcripts of the web-based communications were analyzed in terms of the amount of participation as determined by the number of comments employed, defined in terms of a complete thought unit, a procedure employed by Diane Schallert in her research on on-line communication (Schallert et al, 2001). Each "thought-unit" was also analyzed using a constant comparative method (Glaser & Strauss, 1967) to guide the development of the significant categories and patterns in the data in terms of the types of topics discussed and the literacy practices employed. The types of topics and practices were then crosschecked with an experienced English teacher for further verification (Merriam, 1998).

*WebCT bulletin-board discussion.* The teachers also participated in an asynchronous discussion on the course WebCT site. For this site, teachers were asked by the course instructor to make at least one posting a week; they were told that they could respond to topics or issues in the course discussions, readings, or practicum experiences, as well as other topics outside the course. The instructor hoped that through participation in this bulletin board exchange, students would gain some experience with uses of a bulletin board as a learning tool for use in their own future teaching. The instructor also hoped that the students would acquire an understanding of how writing is driven by social purposes or needs related to participating in a community constituted through a bulletin board exchange. Transcripts of the WebCT discussion were analyzed in terms of the types of literacy practices employed in the exchanges using the same analysis methods employed with analysis of the teacher/student interactions.

## **Results**

### **Hypermedia Productions**

*Development of the initial and following nodes.* Analysis of the hypermedia productions based on the students multi-genre writing projects indicated that 80 percent of the teachers began their multimedia development with a picture of the person with links to the "major nodes" or events of the person's life. It was these major events that lent themselves to links where the students explained the person in more detail using various medias. For example, one student studying Martin Luther King, Jr. began their multimedia development with a picture of Martin

Luther King, Jr. with four links underneath the picture to take them to nodes about “Enemies and Resistance,” “Awards and Supporters,” “Biographical Information,” and “Civil Rights Efforts.” Each one of these four major nodes had a short written description that explained Martin Luther King Jr.’s relationship to each node. In the “Civil Rights Efforts” node, the teacher developed five sub-nodes that described Martin Luther King Jr.’s efforts. These nodes included “Sit-in Demonstrations,” “Passive Resistance,” “Montgomery Bus Boycott,” “Writings,” and “Marches and Speeches.” Within each of these nodes, the teacher used images, texts, or clips to represent the civil rights theme. Within the “Writings” node, the teacher listed and included writings from Martin Luther King Jr.’s books. These writings were obtained through searching the Internet and incorporated within a separate “exploding” Storyspace™ node. To represent the “Montgomery Bus Boycott,” the teacher decided to use a video clip she also obtained from the Internet and to represent the “Passive Resistance” theme; she scanned in pictures that were obtained through a family trip. Teachers integrated a wide range of media texts into their productions, frequently selecting texts most readily available from the World Wide Web.

Other teachers chose to limit their biography to detailed portrayals of a specific period in person’s life because information about that period was more available and they preferred to develop a specific aspect of a person’s life. As one teacher indicated in her learning log, she would rather research the person’s life “using depth, rather than breadth, and develop an understanding that was more meaningful.”

*Analysis of the links employed.* The 27 projects indicated that the most common approach to linking was directly from a picture or words that described themes for analysis placed under a picture. For example, when placing a picture of the “Montgomery Bus Boycott” in a node, a reader would click on the picture to move to an explanation of the boycott and then link back to another node with another theme when finished. Sixty-five percent of the teachers used this approach of simply linking images and texts without use of hypertext links from individual words.

The other thirty-five percent of the teachers used hypertext links in which certain words were linked to other words or texts. One teacher described the life of John F. Kennedy and made links to words that they found most difficult for a reader to outside nodes that either described the word through text, a graphic, or both. The words that were linked were words that the teachers believed would improve the students’ reading experience or that they found most interesting. Of the 35 percent that used hypertext links for development, over 80 percent of them had five or more links within each biographical description. The words that were most commonly linked were those that the teacher believed would provide background knowledge for readers assumed to have no previous knowledge of the person. An example is the links in the nodes on John F. Kennedy, which included the “Cuban Missile Crisis,” “Bay of Pigs,” “Marilyn Monroe,” “Fidel Castro,” and “Camelot.” All of these words were linked to additional nodes that explained John F. Kennedy’s relationship to each of these nodes.

*Analysis of the media employed.* All teachers used digital pictures copied from the Internet or scanned from a book. Thirty percent of the students also used QuickTime movies obtained from the Internet that showed the event in detail. As they indicated in their learning logs, teachers believed that these video clips effectively conveyed ideas they wanted to portray about their person. In addition to pictures and movies, 20 percent of the teachers used sound clips that they prerecorded using SoundEdit Pro™ or that they captured from the Internet to add narration to their project.

Through these hypermedia productions based on the students’ writing, the teachers were using multi-media links to model uses of technology for their students as a tool for portraying a range of different biographical elements of their subjects’ lives

## **Web-based Communications between Teachers and Students**

*Building personal relationships.* Analysis of the web-based communication between teachers and students indicated that the teachers initiated all the comments on the asynchronous discussion board. The initial conversations during the first two weeks of the semester typically began with three-to-five sentence personal anecdotes that served to help establish a personal relationship between the teacher and students. The interaction and writing style during these initial exchanges was relatively formal.

Many of the middle school students described how they enjoyed the ability to communicate on-line to build a better relationship with the teacher before they started the co-inquiry multimedia project. One student said, “because we’re able to communicate online, it was easier to get to know the practicum teacher because it gave me more time to think about what I would want to know from them and how I might want to answer their questions.” Another student said, “I was always excited to check the discussion area when I got home so I could see if my practicum teacher had sent me a message back.” The middle-school students expressed some disappointment to

their teachers when the teacher did not respond immediately to their posting, an indication of their interest in hearing from their teacher.

*Planning and development.* As illustrated by the initial example of work on the Princess Diana project, as the semester progressed, the conversations focused more on planning and developing the multi-genre writing project. While the students normally posed a topic that was directly related to the media and the popular culture, many of the teachers encouraged students to select topics that they found, as one teacher noted, “would be more meaningful and easier to obtain quality information.” During these exchanges, the sentences became much shorter than during the initial exchanges, with incomplete one to two sentence responses. The interaction and writing style also became more informal.

The discussion board served to support the teachers and students in sharing ideas about the content of their multi-genre writing project, sharing involving literacy practices such as posing questions. In the exchanges, teachers frequently posed questions to students regarding further elaboration about their projects, questions that they may then have internalized to think about different aspects of their projects.

The assignment of working with two to four students, each of who was creating a different project was a bit overwhelming for the pre-service teachers. The discussion board helped the teachers monitor the students’ progress on the project to insure that they completed it on time. Some of the teachers commented on the convenience of being able to send multiple messages to the middle school students and determine their progress through their responses. As one teacher noted, “I am able to keep in constant communication with them up to the days I meet with them. We are then able to get much more accomplished as we have been communicating and know what the plan is when we will see each other.”

*Frequency of exchange.* In the exchanges on the multi-genre project, the teachers were more likely to dominate the discussion. Seventy percent of the conversation focused on direction and control comments where the teachers were guiding the students in their research asking them about the progress they were making on research or reminding them what was due the next time they were able to meet. When responses were elicited on research progress, 85 percent of sharing included Internet addresses where students had found information they believed could contribute to the final project.

Analysis of the exchange based on gender differences indicated that male and female students who collaborated with female teachers had a 35 percent greater quantity of discussions overall than with male teachers. Students were also 52 percent more likely to employ what was categorized as “personal” topics with female teachers than with male teachers. There was also a difference within the student group; female students communicated more frequently and also contributed more project-related information than their male counterpart.

Analyzing all of the asynchronous discussions, teachers employed 73 percent of “thought units,” while students contributed only 27 percent. Overall, the focus of the discussions moved from initial personal conversations to project-related conversation during the middle of the semester to personal conversation at the end of the semester.

Given the infrequency of face-to-face meetings during the practicum, this web-based communication served to enhance the quality of teacher/student relationships and provide for frequent collaboration on the project. Through this experience, both teachers and students learned to perceive the value of web-based communication as a tool for engaging in collaborative co-inquiry.

### **Teachers’ WebCT Bulletin Board Communication**

Analysis of the topics addressed in the WebCT class bulletin board exchanges indicated that teachers used the exchanges to discuss a range of different issues, particularly those associated with education: teachers as role models, vouchers, censorship, testing, etc. And, teachers shared their experiences with working in the middle-school practicum, as well as personal experiences. In doing so, they employed a number of literacy practices that served to foster productive exchanges:

*Display of spontaneous thinking.* Teachers used the postings to openly think through a topic or issue, creating a written record of their unfolding thought. Rather than formulate their ideas prior to writing and then write an organized statement, teachers were spontaneously writing out their thoughts in a free-writing mode. They would then entertain alternative, even contradictory perspectives as they formulated their thoughts in a posting. For example, in discussing the issue of teaching expository versus narrative forms to middle-school students, one teacher, responding to another teacher’s belief in the value of narrative writing, noted:

As we discussed in class earlier, there is clearly something going on with my middle-school student that makes the narrative form a richer expressive medium for him. I will, of course, take a look at your link. Also, I would like to see more of the research on this. The stuff we’ve gotten in the program points specifically to class-



differentiated processing. But your post suggests that there is also research pointing to a broader conclusion. But before I do I wanted to affirm your idea about narrative processes superseding linear logical processes in decision-making. I know for myself that the work that I do with I am reflecting on a difficult problem often resembles a conversation more than a reasoned, bulleted list. I wonder where conversational dialogue fits in this paradigm? It's not really narrative, but God knows, it ain't logical! Anyway, I shouldn't say more 'til I've read some. More later.

The spontaneous nature of his thinking is evident in the fact that he poses questions to himself ("I wonder where conversational dialogue fits in this paradigm?") which then stimulate him to further thinking about the issue. He also openly reports on the fact that "I shouldn't say more 'til I've read some," implying that he will continue to think further about the topic.

The fact that these teachers explicitly shared *how* they are grappling with an issue provided other participants with a window on the reasoning employed, allowing others to react to that reasoning.

*Inviting others' participation.* The teachers also commended each other for their comments and invited others to participate or to respond to their postings. The positive comments and invitations implied that they valued the need for others' perspectives as useful, rational beliefs about a topic, an enactment of Davidson's (1984) principle of charity. For example, in discussing the topic of future employment in the job market, one student reacted to another student's description of an interview with a school administrator about her hiring practices:

I liked what you said here.... First of all, way to ask a relevant questions. Along with finding hope in her answer, I'd like to pose an equally practical question. When and how should we be going about searching out opportunities for our own future employment? I am lucky to have a few friends in high places when it comes to the job-search issue, but I think it would be wonderful to be getting some direction on this subject in class. Anyone else have any insights or information for me???

And, by framing their postings in a tentative, exploratory manner—as "passing theories" (Davidson 1984), the teachers were inviting or implying the need for further verification--agreements or disagreements--from their peers. For example, in discussing the topic of grading writing, one teacher formulated his position on the need to provide feedback during the entire composing process:

So, my two cents: I kind of see grading as a process that begins when the paper is assigned and ends when we hand back that last draft. Plus, it bears great weight (some insist that grading should be done away with in comp classes) in terms of the whole process, their process, of addressing and completing a writing assignment. Does this make sense to anyone?

In his positing, he hedges his comments with words such as "my two cents" and "kind of see." He also notes that others hold different perspectives on grading. And, his final invitation, "Does this make sense to anyone?" implies that he himself is trying to "make sense" out of his own ideas about evaluating writing. His invitation evoked a number of reactions in which teachers mutually explored the issue of evaluating writing:

*Engaging in word/role play.* The teachers also frequently engaged in "double-voiced" word play (Bakhtin, 1981), mimicking or parodying persons or discourses. Within the course, the teachers had also participated in a large-group role-play based on the 2000 Presidential election in which they adopted various roles and exchanged written memos with each other. They compared their WebCT exchange with this role-play session in terms of using written texts to engage in verbal play through writing. As one teacher noted:

The experiences with WebCT has really opened up my ideas on communication and possibilities therein...I think both WebCT and the role play offer something priceless to learning, i.e., play. It's learning of and appreciation for multiplicity. There were so many contexts overlapping in that classroom that multiple uses and abuses are inevitable, and, I think, productive. The same is true for the WebCT.

This dialogic word-play included intertextual references to stances and discourses operating in the group and the teacher education program. By mimicking or parodying the language of these stances or discourses, student were formulating oppositional stances reflecting their own beliefs and ideas about teaching and learning.

*Self-reflection on the process.* Teachers also explicitly reflected on or described their stances or attitudes adopted in their postings. In some cases, they apologized for repeating themselves, making overly assertive

statements, or sharing complaints. For example, one student noted: “Whoops, I just browsed back up the thread and realized I’m repeating myself!” After posting a long message, one student commented, “Sorry to drop such a wide load here on the CT, but it was cathartic.” They also valued the fact that they could openly express their opinions within their group without necessarily being concerned about offending others. One student noted, “could you just imagine if we were afraid of speaking our souls for fear of offending someone. Our class would be pretty damn quiet if that were the case.”

A Korean student noted that the site served to foster development of open expression, something she finds lacking in her Korean student peers: “we are too concerned about hurting others people’s feelings to think out loud...I think Korean students have to learn to be more assertive in order to exchange their thoughts.”

Teachers also noted some of the difficulties specific to participating on a bulletin board discussion. One teacher commented on the difficulty of conveying her attitudes: “I don’t know exactly how or why, but threaded discussions transform words. Unless the writer is incredibly skilled, the tone is hard (if not impossible) to communicate. Perhaps it is the instantaneous nature of it that is its main draw and downfall...? Her comment suggests that some participants had difficulty communicating their attitudes in the exchanges.

The teachers therefore used their exchanges on the WebCT bulletin board discussion as a tool for mutually formulating strategies for coping with various issues associated with teaching. Through their participation in these exchanges, they were learning to employ computer-mediated communication as a tool for the literacy practices of displaying spontaneous thinking, inviting others’ participation, adopting an exploratory stance, engaging in word/role play, and reflecting on the process.

## Summary

The results of this study indicated that the teachers and middle-school students were employing the technology tools of hypermedia production and web-based communication to engage in literacy practices involved in their multi-genre writing project and in communicating with each other. These tools served to mediate the uses of various literacy practices within the larger activity system of teacher education, whose object is to assist teachers to acquire those practices involved in working effectively with students.

The teachers used the Inspiration<sup>TM</sup> and Storyspace<sup>TM</sup> tools to define intertextual and hypertextual connections between the texts included in their multi-genre writing project. These hypermedia tools allowed teachers to combine written texts, images, sounds, and video to portray the characteristics of a person in a web-based production for sharing with others, including their students. Creating these hypermedia productions in a co-inquiry project with their students also helped teachers learn how to model the literacy practices of making intertextual or hypertextual connections for students, an important teaching strategy.

With the increased focus on multi-media and hypertext communication in literacy education, English/language arts teachers need to acquire an ability to use this tool as part of their literacy instruction. Teachers also need to be able to employ links that go beyond just illustration to engage in critical interrogation (McKillop & Myers, 1999). One limitation of this project remains the relatively high cost of the Storyspace<sup>TM</sup> software for large-scale use in schools. At the same time, other, less expensive hypermedia software such as Hyperstudio<sup>TM</sup> or HyperCard<sup>TM</sup> can be used as an alternative.

The teachers and students used the web-based communication site as a tool for establishing social relationships and for planning their multi-genre writing projects. This site provided teachers with continuous, on-going interaction with their students, something often lacking in practicum experiences with infrequent school visits. The students expressed a high level of engagement with this site, expressing disappointment when they did not receive responses from their teachers. The written exchange allowed teachers to model a range of literacy practices, particularly self-disclosure about their own lives and posing questions about the project, practices students then demonstrated in their own responses.

One problematic aspect of the exchange was the fact that the teachers dominated the interactions by a ratio of four to one. One possible explanation of this disparity was that the students had minimal access to computers in their school and simply did not have the time to write extensive answers. While students could also access the site from their homes, many students did not have computer access in their homes. Another factor may have been that some students had minimal writing skills; limiting the amount they were able to write. The fact that the students wrote longer entries when they were discussing their own lives and shorter entries when they were discussing their projects suggests that teachers employing this tool need to include a focus on autobiographical topics, as well as topics related to tasks. There were also marked gender differences, with female teachers eliciting more participation from students than male teachers through uses of “personal” connections, suggesting the need for teachers of both genders to employ such connections.

Through their participation on the WebCT bulletin board, teachers were recognizing how participating in an active, on-line community helped them explore issues and concerns related to education. Given this experience, they may then be more likely to participate in similar web sites or employ such sites in their own teaching. And, through that participation, they were employing a number of literacy practices that they could model as participants in teacher/student web-communication.

## References

- Bakhtin, M. (1981). *The dialogic imagination*. Ed. Michail Holquist. Austin: University of Texas Press.
- Barab, S. & Schatz, S. (2001). *Using Activity Theory to conceptualize online Community and Using Online Community to Conceptualize Theory*. Paper presented at the American Educational Research Association in Seattle, WA.
- Barthes, R. (1970). *S/Z*. London: Cape.
- Beach, R., & Lundell, D. (1998). Early adolescents' use of computer-mediated communication in writing and reading. In D. Reinking, M. McKenna, L. Labbo, R. Kieffer (Eds.), *Handbook of Literacy and Technology* (pp. 93-112). Mahwah, NJ: Erlbaum, 1998.
- Beach, R., & Myers, J. (2001). *Inquiry-Based English instruction: Engaging students in life and literature*. New York: Teachers College Press.
- Beach, R., & Phinney, M. (1998). Framing literary text worlds through real-world social negotiations. *Linguistics and Education*, 9(2), 159-198.
- Bergvall, V., & Remlinger, K. (1996). Reproduction, resistance and gender in educational discourse: The role of critical discourse analysis. *Discourse & Society*, 7(4), 453-479.
- Bloome, D., & Egan-Robertson, A. (1993). The social construction of intertextuality in a classroom reading and writing lessons. *Reading Research Quarterly*, 28, 304-333
- Bolter, J. D. (1998). Hypertext and the question of visual literacy. In D. Reinking, M. McKenna, L. Labbo, & R. Kieffer (Eds.), *Literacy and technology: Transformations in a post-typographic world* (pp. 3-14). Mahwah, NJ: Erlbaum.
- Bolter, J.D., Smith, J., & Joyce, M. (1990). *Storyspace*. Cambridge, MA: Eastgate.
- Bruce, B. C., & Davidson, J. (1996). An inquiry model for literacy across the curriculum. *Journal of Curriculum Studies*, 28 (3), 281-300.
- Bruce, B. C., & Easley, J. A., Jr. (2000). Emerging communities of practice: Collaboration and communication in action research. *Educational Action Research*, 8 (2), 243-259.
- Bruce, B. C., & Levin, J. (1997). Educational technology: Media for inquiry, communication, construction, and expression. *Journal of Educational Computing Research*, 17(1), 79-101.
- Cole, M. (1996). *Cultural psychology*. Cambridge, MA: Harvard University Press.
- Cole, M. (1999). Cultural psychology: Some general principles and a concrete example. In Y. Engestrom, R. Miettinen, and R. Punamaki (Eds.), *Perspectives on activity theory* (pp. 87-106). New York: Cambridge University Press.
- Dasenbrook, R. W. (2001). *Truth and consequences: Intentions, conventions, and the new thematics*. University Park, PA: Pennsylvania State University Press.
- Davidson, D. (1984). *Inquiries into truth and interpretation*. Oxford: Clarendon Press.
- Duguay, K. (1999). The pedagogical and electronic contexts of composing in hypermedia. In C. DeWitt, & K. Strasma (Eds.), *Contexts, Intertexts, and Hypertexts* (pp. 15-38). Cresskill, NJ: Hampton Press.
- Engestrom, Y. (1987). *Learning by expanding: An activity theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory*. Chicago: Aldine Publishing.
- Jonassen, D. (2000). *Computers as Mindtools for Schools: Engaging Critical Thinking*. Columbus: Prentice Hall.
- Knoeller, C. (1998). *Voicing ourselves: Whose words we use when we talk about books*. Albany, NY: SUNY Press.
- Landow, G. P. (1997). *Hypertext 2.0: The convergence of contemporary critical theory and technology*. Baltimore: Johns Hopkins Press.
- Lewis, C., & Fabos, B. (1999, Dec. 4). *Chatting on-line: Uses of instant message communication among adolescent girls*. Paper presented at the National Reading Conference, Orlando.

- McKillop, A. M., & Myers, J. (1999). The pedagogical and electronic contexts of composing in hypermedia. In S. DeWitt & K. Strasma (Eds.), *Contexts, intertexts, and hypertexts* (pp. 65-116). Cresskill, NJ: Hampton Press.
- McNamee, S. (1996). Therapy and identity construction in a postmodern worlds. In D. Grodin & T. Lindlof (Eds.), *Constructing the self in a mediated world* (pp. 141-155). Thousand Oaks, CA: Sage.
- Merriam, S. (1998). *Qualitative Research and Case Study Applications in Education*. San Francisco: Jossey-Bass Inc.
- Myers, J., & Beach, R., (2001). Hypermedia authoring as critical literacy. *Journal of Adolescent & Adult Literacy*, 44(6), pp. 538-546.
- Myers, J., Hammett, R., & McKillop, A. M. (1998). Opportunities for critical literacy and pedagogy in student-authored hypermedia. In D. Reinking, M. McKenna, L. Labbo, & R. Kieffer (Eds.), *Literacy and technology: Transformations in a post-typographic world* (pp. 63-78). Mahwah, NJ: Erlbaum.
- Myers, J., Hammett, R., & McKillop, A.M. (2000). Connecting, Exploring, and Exposing the Self in Hypermedia Projects. In M. Gallego & S. Hollingsworth (Eds.), *What Counts as literacy: Challenging the School Standard* (pp. 85-105). New York: Teachers College Press.
- Patterson, N. (2000). Weaving a narrative: From teens to string to hypertext. *Voices from the Middle*, 7 (3), 41-47.
- Perkins, D. N. (1986). *Knowledge as design*. Hillsdale, NJ: Erlbaum.
- Peyton, J., & Staton, J. (1993). *Dialogue journals in the multilingual classroom: Building language fluency and writing skills through writing interaction*. Norwood, NJ: Ablex.
- Porter, K. (2001). A pedagogy of charity: Donald Davidson and the student-negotiated composition classroom. *College Composition and Communication*, 52(4), 574-611.
- Romano, T. (2000). *Blending genre, altering style*. Portsmouth, NH: Heinemann.
- Russell, D. (1997). Rethinking genre in school and society: An activity theory analysis. *Written Communication*, 14(4), 504-554.
- Ryan, G. (1999). "Epistemic Conversations: Creating Socratic Dialogue in Hypertext," In S. DeWitt & K. Strasma (Eds.), *Contexts, intertexts, and hypertexts*(pp. 65-116). Cresskill, NJ: Hampton Press.
- Schallert, D., et al. (2001). *What does it mean to be psychologically engaged in an electronically-mediated classroom discussion*. Paper presented at the meeting of the American Educational Research Association, Seattle.
- Short, K., & Harste, J. (1996). *Creating classrooms for authors and inquirers*, 2nd ed. Portsmouth, NH: Heinemann.
- Smithson, J., & Dias, F. (1996). Arguing for a collective voice: Collaborative strategies in problem-oriented conversation. *Text*, 16(2), 251-268.
- Tannen, D. (1984). *Conversational style: Analyzing talk among friends*. Norwood, NJ: Ablex.
- Tannen, D., ed. (1993). *Framing in discourse*. New York: Cambridge University Press.
- Taylor, P. (1992). Social epistemic rhetoric and chaotic discourse. In G. Hawisher & P. LeBlanc (Eds.), *Re-imagining computers and composition* (pp. 131-148). Portsmouth, NH: Boynton/Cook.
- Vygotsky, L. (1978). *Mind in society: The development of high psychological processes*. Cambridge, MA: Harvard University Press.
- Walther, J. (1996). Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research*, 23, 3-43.
- Wertsch, J. (1998). *Mind as action*. New York: Oxford University Press.

# **A Themed and Collaborative Approach to Teaching Computers and the Internet**

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This research series is a practical and effective approach to exposing middle - and high- school students to fun and useful elements of the Internet, current technology issues and to Microsoft Word, Excel and PowerPoint. The theme for the learning series is one in which the students are owners of music recording companies. Youths are fascinated by careers in the recording industry! The focus of this theme is not on the musical talents, but on the professionals who run these organizations.

## **The Program Community**

The 6-month bi-weekly Saturday program was sponsored by the 100 Black Men of Atlanta under their Project Success initiative. Project Success is a program that allows inner-city middle- and high-school students to be mentored by members of 100 MBA and volunteering college students. The Project Success students and their parents have to be actively committed to the entire program, which includes participation in workshops, training, and cultural events that are designed to teach the students to be productive, progressive, members of society. For each student that stays committed throughout his or her middle- and high-school career, the 100 BMA pledges to pay the full tuition for any college to which the student is accepted. The program is a long-term commitment for everyone involved, including the students' guardians. The 100 BMA are currently into their second round of students to reach college age.

The program community consisted of one instructional designer (me), One instructor (me), approximately 5 undergraduate student volunteers and two groups of 16 – 20 students. The volunteers, each whom had technical experience, floated around the classroom offering help to students who needed it and helped to keep the noise down when the students got a little excited.

The students were broken into two groups. For the first two hours of the half-day program, half of the entire group would work with me and the other half would participate in another part of the program. At the end of the two hours, the two groups would switch activities. The groups were assigned arbitrarily.

## **The Program Theme**

During my volunteer time with Southeastern Consortium of Mathematicians and Engineers (SECME), I found that many – if not most – of the students that we visited wanted to pursue a career in acting, modeling or the music industry and the heaviest concentration was in the latter. I decided from the start to use a theme throughout the program, to put the students in the center of the learning, and to bring about reinforcement. I decided the theme would be that of the recording industry to provide interest and familiarity for the students. Though the theme encompassed the idea of the recording company, the focus of the theme was not on the musical talents, but on the professionals who run the companies. I wanted the students to be in positions of authority.

In each scenario within the learning series, the students were cast as recording company executives who needed to accomplish a particular task for the business. A list of objectives or tools needed to accomplish the task was also included. The instructions that followed the scenario and objectives, which required the use of one of the applications addressed in the program, helped them to accomplish those tasks. I included actual screen captures in the notes, which allowed the students to know exactly what they should see on their screens and it enabled them to work ahead if they liked.

## **Curriculum format**

The objective of the Saturday technology sessions was to expose the students to fun and useful elements of the Internet, current technology issues, and Microsoft Word, Excel, and PowerPoint.

## **Module 1 – Program Introduction**

The first module began with student, volunteer and instructor introductions. To bring cohesiveness, consistency and relevance to the program activities for the students, a general theme for the activities was introduced. Two members of local recording companies were invited and were present to give the students an idea of the importance of computer and technical knowledge in the industry. They also answered a barrage of questions about various facets of the recording industry.

During the module, the students also took a pre-test on the various components of the computer. They were then shown actual internal components of a computer and told of their functions. Finally, they were given a verbal overview of what the entire program would entail.

## **Module 2 – The Internet**

Unit one of the second module included a PowerPoint presentation on the history and current state of the Internet that included definitions, information search techniques and emailing instructions. The students were then lead to the computer rooms where they all were assisted in setting up their own email accounts. They also participated in a World Wide Web scavenger hunt. The scavenger hunt consisted of questions that varied in difficulty. The students were asked to use any of the various search techniques that were introduced in the presentation to find the answers. Once a student found an answer, the student was asked to show the class how that answer was found and received a treat.

Unit two involved more in-depth Internet searching by the students. The students were asked to find three types of websites: recreational, reference and consumer. They were instructed to find three websites for each category (for a total of nine websites) and to give a description of each. The students were then asked to volunteer to share the websites they found. The reports were collected so that a list could be compiled and distributed at a later date. The students were also given a post-test on the components of the computer.

## **Module 3 – Microsoft Word**

The first unit of the third module focused on an introduction to Microsoft Word. The students took a pre-assessment regarding their knowledge of MS Word and received instruction on creating a flyer for their recording company's annual talent show.

The second unit included instruction on creating a research paper in MS Word. The activity was introduced as a report for the recording company CEO about the Internet and web publishing. In the scenario, the report occurred as a result of a suggestion by an executive (the student) about creating a website for the company. Afterward, the students took a post-assessment on their knowledge level with MS Word.

## **Module 4 – Current Events in Technology**

The fourth module consisted of a discussion on the importance of technology. The students were arranged in groups and asked to brainstorm about benefits of having access to a computer and the Internet. The students were also introduced to the highlights of a report called *Falling Through the Net: Defining the Digital Divide* ([www.ntia.doc.gov/ntiahome/fttn99](http://www.ntia.doc.gov/ntiahome/fttn99)). The report, based on the December 1998 U.S. Department of Commerce Census Bureau data, provides an updated snapshot of American use of technology. The report identified that computer ownership and Internet access has increased for all ethnic groups in all locations. Unfortunately, though, groups that were already connected are now far more connected, while those with lower rates of access have increased less quickly. As a result, the gap between the technologically wealthy and the technologically poor is growing. This gap is known as the "digital divide". The report also revealed that there are many factors that create the huge difference between those who have computers and Internet access and those who do not. The children discussed in groups and with the class several ways to provide solutions to the problems.

## **Module 5 – Microsoft Excel**

The fifth module included a pre-assessment and an activity to introduce the students to Microsoft Excel. The activity was presented as scenario regarding record sales for the various recording label artists and the overall recording company. The students created a spreadsheet and accompanying charts and shared their end results with the class. A post-assessment followed the activity.

## **Module 6 – Microsoft PowerPoint**

Unit one of the sixth module began with a pre-assessment on PowerPoint. The students participated in an activity that allowed them to create a promotional PowerPoint presentation for their company's new artist event. In the scenario, the company executive would design the presentation to attract interest and place it on a computer in the student center of a local university.

Unit two provided the students with an opportunity to develop a presentation of their own. The students were asked create an original presentation that included autobiographical information and a 3-, 5-, and 10-year plan for the future. The presentation was also to include family pictures that were scanned into the computer, digital pictures taken in class and graphics imported from the Internet. The students received instruction on visual consistency and quality presentation design.

The third unit of the sixth module began with presentation tips such as eye contact and annunciation. The students were given the opportunity to practice, present to the class and receive feedback. The unit ended with a post-assessment on PowerPoint.

The fourth and final unit consisted of presentations by the students. The students were encouraged to invite their parents to observe the presentations. Sponsors and mentors of the program were also encouraged to attend.

### **Program Conclusion and Assessment**

The program concluded with an opportunity for the students to demonstrate their ability to use the technology through a well-attended voluntary presentation at an assembly for parents and program sponsors. Evidence of the effectiveness of the instruction was provided through a statistical comparison of the pre- and post-tests, as well as comments of interest, excitement and approval from several of the program students, their parents, and Project Success volunteers and employees.

### **Jonassen's Seven Aspects of a Technology In tegration Learning Environment**

According to Jonassen (1999), technology integration does not happen in a particular location, but in a particular learning environment. That environment includes a learner-centered-teacher-as-facilitator atmosphere and seven additional aspects that make the learning meaningful. The learning environment is active and requires students participate in the processing of information; it is constructive, so students are encouraged to integrated new ideas into their prior knowledge; it is collaborative, which allows students to work in learning communities; it is conversational, so that students share ideas and build upon each other's knowledge; it is contextualized or situated in real world task or problem-based activities; it is intentional, and students are made aware of cognitive goals and objectives at the onset; and it is reflective, where students are encouraged to reflect on the process and articulate what they have learned.

The overall theme of the technology learning series was that of a recording company in which the students were corporate executives acting on behalf of the company. Each of the seven aspects was present within the instruction produced for the program. For instance, with their prior knowledge of and interest in recording companies, students were able to put the new information regarding the software applications into context; students were assigned ownership of their recording companies and were given positions of action and authority within the business. They were also allowed to choose an "executive board" of three to four members. This allowed them to learn in teams. The team atmosphere allowed the students to share ideas and construct the knowledge-building communities. The modules began with a scenario that put the instruction into a real-world perspective for the students and each scenario was followed by a list of objectives for the instruction, so students were made aware of the concepts that were to be learned. Many of the modules also ended with an opportunity for the students to share their projects with the other teams, talk about their process, and answer questions asked by the instructor and other students.

### **Lessons learned**

There were several valuable lessons that I learned while participating in this technology program, most of which had nothing to do with the technology itself. Most had to do with the relationships and dynamics of the classroom.

### **Use a title with your name in the beginning**

First, I would have asked them to call me Ms. Teshia. I did not do that at first because most of the adult volunteers were addressed by their first names and I wanted to “fit in” but what I failed to realize was that those kids had long-term intimate relationships with those people that made it appropriate. I had not established myself in the community and had not earned the respect of the students, so I was placing myself on the peer level with them instead of earning my position. If I had it to do again, I would have asked them to call me Ms. Teshia and considered allowing them to do otherwise once we grew our relationships. It is very hard to go the other way.

### **Include plenty of conversation and break time for students**

Break time was the time when I got to know the kids on personal levels, when they got to know me, and when they got to fellowship with each other. I suggest taking plenty of breaks. You can get them to stay on task if they know a break is coming up soon. Also, since the program is not compulsory, it should not feel like hard work and school, but fun like computer camp. This was also a time when I got a chance to truly learn about the likes and dislikes of the kids’ generation, which informed my design of the activities.

### **Allow the use of home language at times**

Home language should be permitted in the classroom in certain situations. I allowed them to talk amongst themselves in a way that is comfortable to them but not offensive to anyone. They even communicated with me in a respectable manner in a form of their home language. However, when it came time to present, they were asked to use Standard English. Presentations were voluntary, and they knew by volunteering, they would have to present using Standard English. Most were more than compliant.

### **Place no labels or stereotypes on the students**

Even though you have to try to find out all you can about the students before the course in order to design the instruction, do not associate the students with labels as a result of that inquiry. It can prove to be harmful to their self-images and counter-productive to the instruction.

### **Use small groups**

The kids flourished in small groups! Students brainstormed and named their recording companies, and many of the groups even designed a logo and assigned roles within the recording company.

### **Make certain the theme has relevance for the learners**

It was so important to have lessons that had relevance to the students because they embraced the learning. They saw immediately how they could use that new knowledge and they wanted to learn.

### **Include group policy making at the start of the program**

It became necessary towards the middle of the program to establish some rules of behavior. The program was voluntary, so there were kids who came every session and those who came every once in a while. There were also those who behaved very well and those with whom we had challenges. We had instances where our group disrupted others in the building and times when a few members of the program disrupted other members. So we had to come up with rules that the kids understood and embraced. We decided to include the students in developing a list of acceptable and unacceptable behavior and the consequences of both and had them sign it. It curtailed many behavioral problems. In retrospect, I would have done that much earlier in the program and I would have kept a student signed copy and sent home a copy that had the student’s signature for the parent to sign and return, just to cover all bases.

### **Conclusion**



The themed and collaborative approach to teaching computers and the Internet worked well because the program was a community effort and there was a consistent theme throughout the program that engaged the students and gave meaning and practicality to the content. Each of the modules included screen captures and collaborative activities, which allowed the students to work at their own pace and communicate understanding of the content with group members. Jonassen's seven aspects of a technology integrated learning environment certainly informed the design and implementation of the themed series, but group policy making, frequent breaks, and an absence of stereo types of the students were instrumental to the success of the learners.

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### **Reference**

Jonassen, D. H., Peck, K. L., & Wilson, B. G. (1999). *Learning with technology: a constructivist perspective*. Upper Saddle River, N.J.: Merrill.

# Defining and Ensuring Academic Rigor in Online and On-Campus Courses: Instructor Perspectives

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## Abstract

*This study attempted to define what academic rigor means to the faculty members and graduate assistants who taught on-campus and online courses at a major Midwestern state university. The study sought to discover the level of importance these instructors gave to academic rigor and what strategies they used to ensure academic rigor in their courses. Finally, the researchers asked instructors about their strategies to ensure academic rigor in these two different delivery methods.*

## Introduction

Academic rigor is a topic that resides at the very core of the traditional conception of the academy. While precise definitions (Winston et al., 1994; Braxton, 1993; Nicholson, 1996) may vary, the basic idea is central to postsecondary education as it has been implemented in the past few hundred years. However, at the dawn of this new millennium, the popularity of new pedagogical beliefs and instructional strategies, such as constructivism and problem-based learning, and delivery methods, such as online distance education, make it clear that it is time to review our conceptions of academic learning and to see if old definitions match the postsecondary educational practices of the new millennium.

The amazing growth of online distance education, in particular, heightens the need for this type of study. As enabling technologies such as computers and the Internet have become more ubiquitous in the U.S., distance education programs have become increasingly popular in both formal academic settings as well as corporate settings. Specifically, over the past five years there has been a move by many institutions of higher education to provide some kind of online learning opportunities. According to a recent MSNBC report (McGinn, 2000), 75 percent of all U.S. universities now offer online coursework, and 5.8 million students have taken online college courses. This rapid movement towards offering online courses has caused some concern, especially in academic communities, regarding the wisdom and implications of this trend. One of the concerns that is often voiced (Phipps & Merisotis, 1999; Rutmania, 1999) implies that online courses are not as academically rigorous as traditional face-to-face courses. If this is truly the case then the academic reputation of the institution could possibly be at risk.

This study attempted to explicitly define what academic rigor means to the faculty members and graduate assistants who taught on-campus and online courses at a major Midwestern state university. The study also sought to discover the level of importance these instructors gave to academic rigor as they designed their course offerings, and what strategies they used to ensure academic rigor in their courses. Finally, the researchers asked those instructors who taught both online and on-campus courses about their strategies to ensure academic rigor in these two different delivery methods.

## Research Questions

This research study attempts to answer three primary questions:

How do instructors define academic rigor?

How important is academic rigor to these instructors?

What strategies do these instructors use to ensure academic rigor in their on-campus courses?

For those instructors who teach both on-campus and online, what strategies do these instructors use to ensure academic rigor in their online courses? Are these strategies different than the strategies used in their on-campus courses?

Our hypotheses going into the research were that instructors would have a variety of definitions of academic rigor, but that important similarities would emerge, and that the differences in definitions would also be of interest. We assumed most instructors would view academic rigor to be of great importance in their course design.

We thought that instructors would have a variety of strategies for ensuring academic rigor and that, again, we would find a core group of strategies, with interesting variations to report as well. Our hypothesis regarding the difference between ensuring rigor in online and on-campus courses, based on informal conversations with instructors of both types of courses prior to the research, would be minimal, and that similar strategies, though obviously influenced by the medium used to deliver the course, would be employed.

### **Significance of Research**

There are many reasons why this research is significant to instructors and administrators at postsecondary institutions, especially those institutions embarking upon distance education initiatives. Three key areas of impact are described below.

#### **Evaluation and improvement of current on-campus and online courses**

Most instructors, we feel it is fair to say, would agree that there is a need for the continual evaluation and improvement of their course offerings. If our hypothesis that academic rigor is important to instructors is correct, then our findings relating to the first research question should provide some clear criteria regarding academic rigor which then can be used to evaluate the extent to which it exists in current course offerings. Additionally, the findings of the third and fourth research questions will most likely shed light on specific strategies relating to academic rigor in on-campus and online courses that can be focused on to improve the academic rigor of both types of courses.

#### **Promoting discussion of academic rigor among faculty**

We hope that the results of the research will help to promote discussion of academic rigor and related pedagogical issues among faculty. By reading about others' strategies for ensuring academic rigor, they may be moved to discuss these strategies and their own with their colleagues.

#### **Providing an opportunity for distance educators to share their beliefs about, and strategies to ensure, academic rigor**

Any study that looks at the concept of academic rigor and does not also discuss it in the context of online distance education is doing a disservice to its readers, given the prevalence of these courses today (McGinn, 2000). Distance educators have been accused of providing less-than-rigorous courses voiced (Phipps & Merisotis, 1999; Rutmania, 1999) and we wish to give them an opportunity to dispel these notions, if they are indeed incorrect in the eyes of the instructors involved.

### **Past Research**

Our review of the relevant research shows that the topic of academic rigor is mentioned throughout the literature, but that only in a few instances is the meaning of the term specified. We were only able to find three cases in which the term academic rigor was explicitly defined in some way. Below we include the three different definitions. Being that the concept is a complicated one, rather than trying to restate and summarize the elaborate definitions we encountered, and risk losing some of the authors' meaning, we will present below three of the best definitions that we found in their entirety.

An environment that is intellectually challenging and demanding. Students perceive a norm of excellence and responsibility, which is expressed through high, but realistic, evaluation standards. The class is seen as fast-paced, and there are expectations that students will invest considerable energy and time in completing assignments (Winston et al., 1994)

Academic quality is manifested in such course-level academic processes as the type of questions faculty ask students during class, the nature of term paper assignments or other written exercises. (...) [AR is] the level of understanding of course content to be demonstrated by students while engaging in these course-level processes. (Braxton, 1993)

Rigor—focused and critical work—arises from a sense of the importance of subject matter and the opportunity presented for its mastery and refinement through study. (...) In a rigorous academic environment, the purposes, principles and methodologies of scholarship as a means of establishing the connectedness of things is understood. (Nicholson, 1996)

All three of these definitions have different foci. While Winston’s definition focuses on student output and perception of a course, Braxton’s definition focuses on the instructor’s efforts as well as the learning outcomes of the course and Nicholson’s definition centers around a more traditional awareness and use of methodologies.

Although most of the articles that referred to academic rigor did not explicitly define the term they often had embedded within the text phrases that have helped us to gain a better feel for what they meant by academic rigor. Table 1 has a list of key phrases relating to academic rigor from some of the articles that were reviewed. It is important to note that despite the fact that academic rigor is used in many different ways, it is almost always referred to as being a positive attribute that a program or course should have under ideal circumstances.

Reference	Terms
Ridley et al., 1998	“course achievement as measured by grades” “concern that instructors have applied comparable standards in assigning grades to their online or traditional students”
Snell et al., 1999	“Online or distance learning is harder than offline or traditional classroom learning” “it appeared that online courses were more rigorous” “less withdrawals and failures among the traditional offline group”
Thomas, 1998	“academically challenging” “number of homework assignments”
Kerr, 1990	“Depth of study in areas such as foreign languages and mathematics” “Quality: Four or five academic subjects each year” “Balance: Evidence that the student took a broad curriculum” “Trends: Evidence as to whether the student’s grades are gradually improving each year”
Rossman et al., 1996	“increased requirements” “more rigorous content standards” “students maintain a specific grade point average” “more challenging program of study” “taking more courses” “taking more challenging courses” “taking more course breadth”
Taylor et al., 1991	“critical thinking” “mastery of a body of facts” “development of writing skills” “acquisition of library and research skills” “substantial reading and writing assignments” “analysis and interpretations of primary sources” “assignments that foster critical thinking and interpretative skills”
Niles et al., 1990	“liberal education” “equip individuals with the skills and understanding necessary to perform their duties”
Bursuck, 1994	“educational rigor” “higher standards” “increased accountability” “higher expectations for student performance” “assigning more homework to students”
Roundtable, 1997	“academic rigor demanded by the national curriculum” – content coverage? Skills vs. knowledge outcomes in curriculum
Hayes, 1997	“the ultimate test of the student’s academic preparation and intellectual ability . . . comes at the time of university admission exams” “academic standards” “academic demands” “scholarship and academic excellence” “academic achievement” “academic effort”

Table 1. Key phrases related to academic rigor from the literature.

Craig Nelson, a Biology professor at Indiana University, spoke at Indiana University's 18<sup>th</sup> Annual Spring Symposium, *Listening to Learners: Creating Contexts for Student Success*. The title of his presentation was "How We Defeat Ourselves: Dysfunctional Illusions of Rigor." Although his talk did not directly address what academic rigor *is*, it shed light on the subject by addressing what he felt academic rigor *is not*. The illusions of rigor that he presented expressed the idea that rigor is not:

- Hard courses that weed out weak students
  - Avoiding "pampering" students (e.g., giving them flexibility etc.)
  - Covering more content (Nelson, 1989)
  - The difficulty of the exams
- (Nelson, 2000a)

In an article (1997) entitled "Tools for Tampering with Teaching's Taboos," Nelson promotes the importance of "critical thinking" in the college classroom. He provides several methods or tools for getting students to think critically about what they are learning.

### Methodology

The goal of the research was to answer the research questions outlined above. The following general steps were taken in this effort.

The first step of this phase was to determine how other individuals and institutions have defined academic rigor, by conducting an exhaustive review of the past research in this area. Because of the variations of academic rigor, and the fact that the concept was often referred to under different names, this research effort was quite challenging.

The findings from the literature review were used to inform the questions that were asked in an initial set of interviews of a purposefully chosen group of instructors at the aforementioned large Midwestern state university. These instructors were chosen from throughout the university's many schools and departments (see Table 2). The purpose of this initial data gathering was to acquire a larger body of information regarding academic rigor from which more targeted and precise questions could be created for the final survey.

In addition to the demographic information presented in Table 2, it is important to note that of the instructors interviewed for this study (n=8), 2 were full professors, 3 were associate, visiting or adjunct faculty, and 3 were advanced graduate students serving as associate instructors. Of this group of instructors, 3 had taught online as well as on-campus, and thus our findings for question 4 will be based on responses from these instructors.

Department	Gender	Years Teaching Online	Years Teaching On-campus
School of Nursing	Female	2	12
Leisure and Recreation	Male	0	3
Biology	Male	0	34
English & School of Continuing Studies	Female	0	3
Telecommunications	Female	0	5
Language Education	Male	2	5
Curriculum and Instruction	Male	0	25
Instructional Systems Technology	Female	3	5

Table 2. Demographic information about interview participant

The questions posed of our interview subjects were as follows:

- What is your personal definition of academic rigor?
- How important do you feel academic rigor is? Why?
- What do you do to ensure academic rigor in your courses?
- Do you do different things in your online courses compared with your on-campus courses to ensure academic rigor? If so, what?

The final step in our research study procedure was to review and summarize the data collected through the interviews. Similarities and differences in the perceptions related to academic rigor were noted.

## Findings

### Definition of Academic Rigor

What it <i>IS</i>	What it <i>IS NOT</i>
critical thinking high standards and expectations process more than product cognitive development	not grades not memorization not regurgitation

Table 3. Common responses to the academic rigor definition question

What it <i>IS</i>	What it <i>IS NOT</i>
norm referenced content coverage gatekeeper of academy scholarship/peer review student involvement pushing students beyond comfort level	not time based not giving lots of tests not lots of people who fail

Table 4. Interesting but uncommon responses to the academic rigor definition question.

Our analysis of the interview data related to the definition of academic rigor developed into a two separate listings: of common responses to what academic rigor was and was not (Table 3), and interesting but less common responses to the question (Table 4). Given that the responses to the question had such interesting variations, we felt it was necessary to report them, especially given that survey data might potentially find that the alternate definitions might be held by a significant number of respondents.

### The Importance of Academic Rigor

Based on our interviews with faculty members, we found:

- As expected, all participants agreed that academic rigor is important
- Two instructors said that its importance varied depending on the level of the course (e.g., rigor was more important for higher-level courses)

### Methods for Ensuring Academic Rigor with On-campus Courses

After analyzing the data from our interviews with faculty members, we found a diverse collection of strategies that nonetheless seemed to fit well together. We divided these strategies into seven categories, with one or more strategy associated with each category. Unfortunately, it is beyond the scope of this study to go into specific details about how each strategy should be implemented, but hopefully this list of strategies should be of benefit to online educators.

Expectations:

- Make expectations clear
- Make expectations high
- Make grading criteria explicit

Selection of Readings:

- Provide high quality readings/texts
- Provide materials a step above students' level
- Provide a variety of materials

Critical Thinking:

- Require and support students' efforts to examine multiple issues from multiple perspectives
- Require students to cite the readings
- Require student reflections

Modeling:

- Model good scholarship
- Model rigorous thinking

Support:

- Provide appropriate scaffolding for learners

Discourse:

- Ask questions that encourage thinking about relationships and not memorization

Assignments:

- Create challenging assignments
- Create assignments that require higher cognitive processes
- Design authentic and realistic projects and problems for the students

### Methods for Ensuring Academic Rigor with Online Courses

Based on our interview data, we found that, in general, similar methods for ensuring academic rigor seem to be used for online as well as on-campus courses, which means that the list directly above should be relevant also for online courses. However, some instructors did note some differences in their teaching methods related to academic rigor in the online delivery method. Some instructors felt that, in their online courses, they:

- Put more demands on students because of the absence of feedback from face-to-face contact
- Structured online discussions more carefully
- Made expectations even more explicit than they did with on-campus students
- Expended more effort to get feedback from students

Interestingly, one instructor went on to say that *if* content coverage was equated to academic rigor then:

- The same methods will work online as in the classroom
- The online course can be more academically rigorous than the on-campus course because of up-to-date resources

However, he stated that, in his mind, rigor was not the same as content coverage, and that other things, such as the quality of instructor-student and student-student interaction, were as important, if not more so, than merely providing specified content, and thus required different strategies for online delivery. He did not, unfortunately, specify these differing strategies.

### Rigor, Difficulty, and Support

One of the faculty interviewees, Craig Nelson, has been nationally recognized for excellence in teaching at a post-secondary level. Nelson (2000b) provided some insights related to academic rigor that we feel are particularly relevant to the online delivery of courses.

His first observation was that oftentimes faculty and students have a false conception of what academic rigor is. We often confuse the *rigor* of a course with the *difficulty* of a course. He claimed that a more accurate synonym to describe academic rigor would be the word "*challenge*." It was insightful for us to think of academic rigor or academic challenge as having the following relationship with course difficulty and the support provided to the distance students. Nelson (2000b) related these three factors using the equation in Figure 1.

$$\text{Difficulty} = \frac{\text{Academic rigor}}{\text{Support}}$$

Figure 1. Relationship between course difficulty, academic rigor and student support.

This helps us to understand that the difficulty of a course is inversely proportional to the support that students are given. Thus the difficulty of a course increases as the support for the students in the course decreases. Similarly, the difficulty of a course could be low and the course could still be academically rigorous if adequate and appropriate support is provided to the students.

This understanding of the relationship between *difficulty*, *academic rigor*, and *support* is particularly important in a distance learning environment because of high dropout rates. Students are more likely to drop out of a distance program as the courses become more difficult and exceed the students' ability or willingness to persevere. Instructors teaching distance education courses, Nelson (2000b) argues, should maximize the challenge that a student experiences but not the difficulty that a student experiences trying to meet that challenge.

### Limitations

It must be stated at this point, that, even though our findings from our interviews were quite interesting and potentially quite useful, they are based on quite a small sample size (especially research question 4, which was answerable by less than half of our already small sample, who taught online as well as face-to-face). Another important limitation is that the sample only included faculty from a single institution.

### Conclusions

The purpose of this study was to gain a better understanding of academic rigor in online and on-campus postsecondary education. In order to do this accurately, the researchers attempted to define factors that instructors understood "academic rigor" to consist of, as well as quantify how important academic rigor is to these instructors. Information about strategies used to ensure academic rigor in online and on-campus courses was also gathered.

While the results reported in this report are based on a very small sample size, the findings are promising, and the researchers feel that this study will be of great interest to both on-campus and online educators and administrators interested in ensuring the academic rigor of their courses.

### References

- Braxton, J. M. (1993). Selectivity and rigor in research universities. *Journal of Higher Education*, 64 (6), 657-75.
- Bursuck, W. D., (1994). Introduction to the special series on homework. *Journal of Learning Disabilities*, 27(8), 466-9.
- Kerr, B. (1990). *College planning for gifted and talented youth* (ERIC EC Digest #E492). Reston, VA: ERIC Clearinghouse on Disabilities and Gifted Education
- Klesius, J. P., Homan, S. P., & Thompson, T. (1997). Distance education compared to traditional instruction: the students' view. *International Journal of Instructional Media*, 24(3), 207-20.
- McGinn, D. (2000, April 16). *Going to college online* (On-line). MSNBC. Available: <http://www.msnbc.com/news/395503.asp#BODY>
- McMurtrie, B. (1999, December 7). Decision is delayed on agency's authority to accredit distance-education programs. *The Chronicle of Higher Education* [Online]. Available: <http://chronicle.com/free/99/12/99120701u.htm>
- Mikulecky, L. (1998). Diversity, discussion, and participation: Comparing Web-based and campus-based adolescent Literature Classes. *Journal of Adolescent & Adult Literacy*, 42(2), 84.
- Nelson, C. E. (1989). Skewered on the unicorn's horn: The illusion of a tragic trade-off between content and critical thinking. *Teaching of Science*, 17-27.
- Nelson, C. E. (April 7, 2000). *How we defeat ourselves: Dysfunctional illusions of rigor*. Paper presented at the 18<sup>th</sup> Annual Spring Symposium of the Scholarship of Teaching and Learning program at Indiana University, Bloomington, IN.
- Nelson, C.E. (personal communication, April 17, 2000)
- New school ties. (1997, November). *People Management*, 23(3), 24-9.
- Niles, S. G., & Wallace, G. (1990). Education in the Jeffersonian tradition. *Education*, 111(2), 156-8.



- Phipps, R., & Merisotis, J. (1999, April 15). *What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education: A Report from The Institute for Higher Education Policy* (On-line). Available: <http://www.ihep.com/PUB.htm>
- Ridley, D. R., & Husband, J. E. (1998). Online education: A study of academic rigor and integrity. *Journal of Instructional Psychology*, 25(3), 184-88.
- Roblyer, M. D. (1998). Is distance ever really dead? Comparing the effects of distance-learning and face-to-face courses. *Learning and Leading with Technology*, 25(8), 32-4.
- Rossman, G. B., & Wilson, B. L. (1999). Context, courses, and the curriculum: Local responses to state policy reform. *Educational Policy*, 10(3), 399-422.
- Rutmania, R. (1999, August 25). Distance learning: Virtual universities of the near future. *Daily Californian* (on-line). Available: <http://www.dailyca.org/article.asp?id=99&ref=news>
- Snell, J., & Mekies, S. (1999). Online education and academic rigor: A research note. *Journal of Instructional Psychology*, 26(3), 194-5.
- Spooner, F, Jordan, L., & Algozzine, R. (1999). Student ratings of instruction in distance learning and on-campus classes. *The Journal of Educational Research*, 92(3), 132-40.
- Taylor, M. T., & Rendon, L. I. (1991). The American history curriculum in North Carolina's public community colleges and universities: A comparative study. *Community College Review*, 19(1), 36-41.
- Thomas, B., & Bolen, Y. (1998). Student perception of the academic rigor of the college physical education curriculum. *Physical Educator*, 55(1), 2-8.
- Winston, R. B., Vahala, M. E., Nichols, E. C., Gillis, M. E., Wintrow, M., & Rome, K. D. (1994). A measure of college classroom climate: The college classroom environment scales. *Journal of College Student Development*, 35(1), 11-18.

## Kids as Airborne Mission Scientists: Designing PBL to Inspire Kids

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*Problem-based learning (PBL) has great potential for inspiring K-12 learning. KaAMS, an example of PBL, was designed to help teachers inspire middle school students to learn science. The kids participate as scientists investigating environmental problems using NASA airborne remote sensing data. This paper provides an overview of the instructional design challenges in creating web-based PBL teacher support materials, the PBL model we selected, the activities embedded in the PBL, and initial results of classroom trials.*

### Introduction

Kids can be motivated and inspired by making direct contributions to solving real scientific issues. Can teachers be inspired too? Through a PBL approach, KaAMS, a NASA funded project guides teachers to take middle school children on live and past NASA airborne missions to collect data to study two environmental issues. The ultimate mission of the project was to inspire kids to learn and develop a career interest in science, math, technology and geography by their participating as scientists in activities punctuated by “bursts” of interactive events culminating in the analysis of data from NASA airborne missions. The mission is accomplished by providing resources to teachers to use with middle school children. To do this, we developed two problem based learning modules addressing two different environmental issues—active lava flows and coral reefs in Hawaii. The modules consisted of new *lesson plans* that could be used flexibly by many teachers, and that use *existing* NASA and other web resources. The goal was to harness those resources that exist rather than create totally new ones.

### Problem-Based Learning Literature—the basis for KaAMS

The conceptual framework of problem-based learning model for KaAMS is based on the perspectives and implications of problem-based learning literature. Problem-based learning as an instructional model associated with the new learning paradigm (e.g., Reigeluth, 1999) has been implemented in diverse content domains such as medical education, business education, social education, and science education. Problem-based learning, in general, encourages students to engage in learning activities to solve a real world problem (Duffy & Cunningham, 1996). According to problem-based learning researchers (Barrows, 1986, 1992; Savery & Duffy, 1995; Schwartz, et al, 1999), key characteristics of problem-based learning include the following;

- Real-world problems with a motivational context to drive learning. A real world problem is used as a stimulus for authentic activity.
- Given a problem space, students generate their own learning goals in terms of what they will attain.
- Multiple learning resources including print, electronic and humans are provided for the student to develop a deep understanding about content knowledge related to the problem and apply that knowledge into the problem solving activities.
- Students as active problem solvers work with their peers, teachers, and experts to share their different perspectives and develop deeper knowledge on a subject area.
- By placing students in learning by doing situations, students develop a disciplinary knowledge base, problem solving skills, reflective thinking skills, and collaboration and communication skills.
- Teachers play a role as coach or facilitator that supports students’ learning and problem solving activity, rather than directly teaching what students should know and how students should solve a problem.

In general problem based learning (e.g., Barrows, 1986, 1992; Savery & Duffy, 1995; Schwartz, et al, 1999), students engage in the following five stages of a learning process:

- *Present a problem*—Students start with a presentation of a real world problem.

- *Generate what students know and what they need to know*—Students actively define problems and generate what they know and what they need to know based on their prior knowledge and experience. They are encouraged to identify learning issues or knowledge necessary to construct an understanding about how to solve problems.
- *List possible actions*—Based on the previous activity, students discuss and come up with strategies and activities for solving the problem.
- *Collect and analyze information*—All students engage in gathering information from available learning resources ranging from print-based materials, electronic and human resources and from the designated facilitator. After gathering the information, they analyze and evaluate information in terms of what is most useful or what is not useful to solve the problem. They discuss and negotiate their perspectives about alternative solutions with peers, their teacher, and experts.
- *Present and share solutions*—They finally propose their solutions, share them with their peers and experts who might provide different perspectives to the solutions, and revise their solution based on feedback from their peers or experts.

### **The KaAMS Model**

From these perspectives and implications of the problem-based learning literature, we developed the KaAMS problem based learning model with four learning stages in which middle school students engage: 1) problem scenario, 2) propose ideas/search information, 3) conduct mission/collect and analyze data, and 4) propose solution. Each learning stage of the KaAMS problem based learning model includes the following key attributes:

- Authentic, ill-structured problem situation
- Assumption of roles by the students
- Reflections about what they know, what they need to know
- Planning the investigation procedure
- Access to rich NASA web resources
- Active investigation
- Learning activities situated within real NASA missions
- Reflective thinking exercises
- Peer and expert collaboration
- Learner activities/tools in interpreting data gathered
- NASA scientist support
- Shared solutions with peers and experts

### **Conceptual Framework for KaAMS**

#### **Foundation of KaAMS**

Conceptually, the KaAMS framework, as shown in Figure 1, is built upon the premise and foundation that among all NASA web resources from all aspects of the agency, a multitude of resources can be used in the classroom. These resources are filtered through a second-level premise, which is the Web-Enhanced Learning Strategies (WELES) interface. This interface helps to sift through the available resources for elements and composite sites that are appropriate for use by middle school teachers and students. These resources are then used in four parts of a lesson plan—frame/inform/explore/try. The third premise is that teachers can use real web resources from real NASA missions in a problem based lesson format. Finally, these three levels of resources are harvested as part of the KaAMS PBL lesson plans.

Students are presented with an environmental problem that is of concern of to a NASA mission. They begin a series of problem-solving lessons from which they develop content and applied knowledge by participating in problem solving activities. Through a series of framing and informing activities, students search for additional information on the problem, develop an understanding of the science of the problem, and propose a solutions for conducting a mission that will provide remote sensing data to solve the problem. Students become involved in “bursts” of activities to conduct a mission, collect and analyze data. Finally, students summarize their findings in several different ways and go public to share what they have learned with classmate and/or other outside their classroom. One important note is that the students participate in reflective activities throughout the entire process.

#### **Developmentally Appropriate Lessons**

Also evident in the design were the following key characteristics we found about middle school students (From: This We Believe).

- Moving from concrete to abstract thinking
- Curious on a wide range of topics, few of which are sustained
- Prefer active over passive learning
- Respond positively to participating in real life learning situations
- Are inquisitive and challenge adults
- Desire recognition

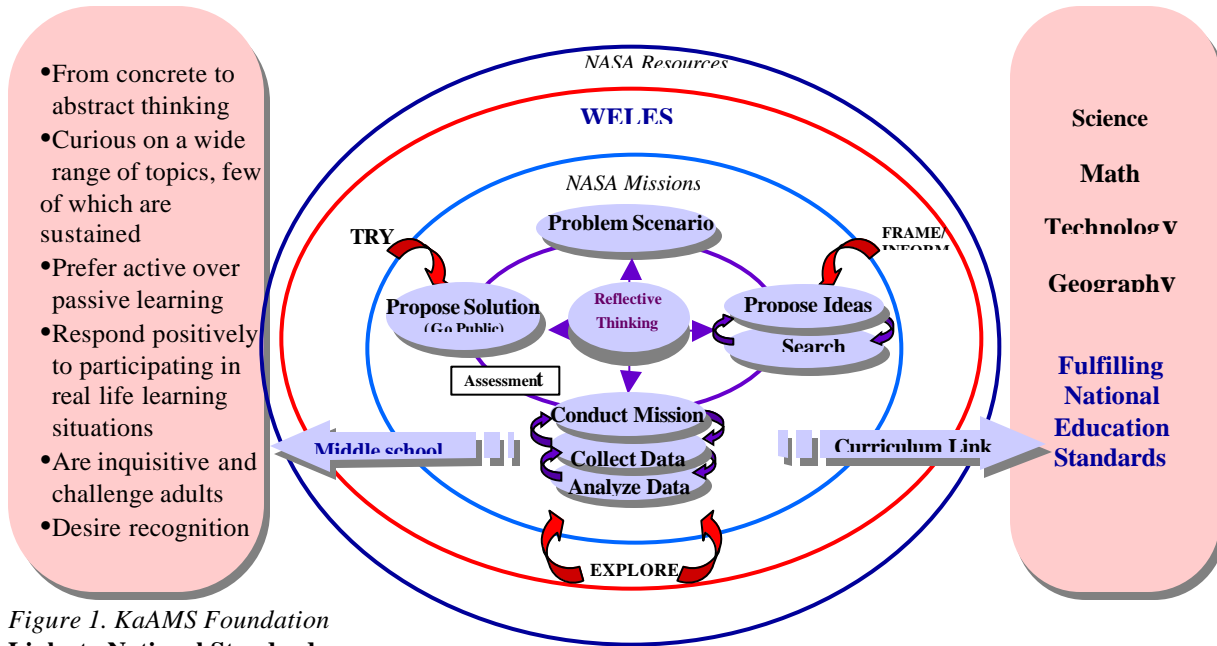


Figure 1. KaAMS Foundation  
**Links to National Standards**

To maintain the link to the National Standards, we have completed an analysis of the NSTA/NRC standards and the AAAS Project 2061 Benchmarks to target in the KaAMS Project. Each lesson plan links to the specific national education standards that might be satisfied by completing the lesson activities

**Flexibility**

Since flexibility is very important to maximize the usability of this site, we have designed the site for the teacher. The framework is constructed so that the teacher is in control of how much and what types of the available activities that his or her students actually see. He or she can start from Phase 1 and proceed to Phase 4, or he or she can just go the activities of Phase 3, for example.

**Mapping Design Attributes of KaAMS onto PBL and the Scientific Process**

Problem-based learning and the scientific process follow similar steps. This cross over made explaining the learning process to content experts very easy. See Table 1. Some examples of how the design attributes were built into the KaAMS is shown in the last column.

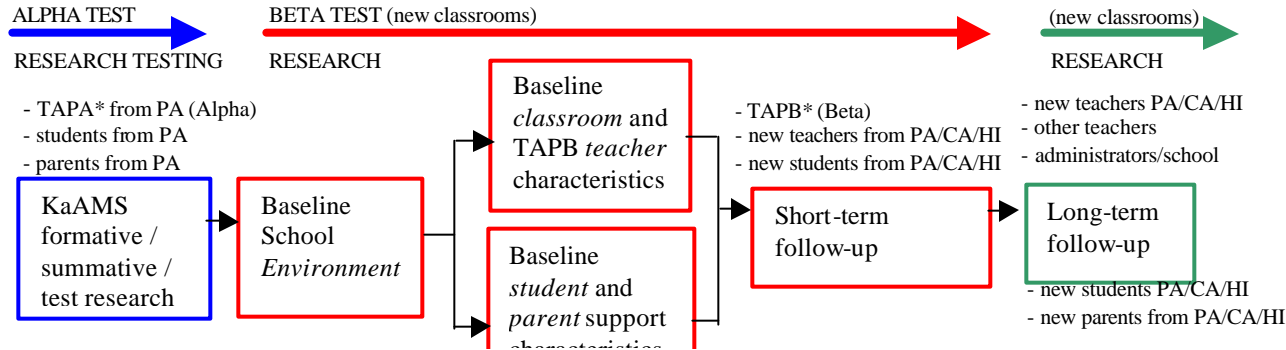
Table 1. Mapping KaAMS onto the PBL Process

PBL Process	Scientific Process	KaAMS	Design Examples
Problem Clarification	Identify Problem	Problem Scenario	<ul style="list-style-type: none"> <li>• Two problems — finding lava flows for the Pacific Disaster Center, and determining if the coral reef need protection for a real Congressional Executive Order</li> </ul>
Plan Development	Research ideas and	Propose Ideas/Search for	<ul style="list-style-type: none"> <li>• Activity Sheets as</li> </ul>

	Develop plan for investigation	Information	<p>Who, What, When, Where, Why and How questions to determine what the students know</p> <ul style="list-style-type: none"> <li>• Students complete reflection journals</li> <li>• Find information using existing NASA web resources</li> <li>• Participate in activity bursts to explore new concepts</li> </ul>
Collect Information	Collect Data	Conduct Mission and Collect Data	<ul style="list-style-type: none"> <li>• Students think critically about which aircraft can run their mission and select from several possibilities</li> <li>• Students plan the actual mission and compare it to the actual NASA mission</li> </ul>
Analyze Information	Analyze Data	Analyze Data	<ul style="list-style-type: none"> <li>• Students use actual data from the live missions to draw conclusions</li> <li>• Students use guidelines from NASA scientists for interpretation of their data</li> </ul>
Present Solutions	Report Findings	Propose Solution: (Go Public)	<ul style="list-style-type: none"> <li>• Write a report to the Pacific Disaster Center,</li> <li>• Make recommendations to the President in response to his executive order</li> </ul>

**Alpha Testing Phase**

The assessment strategy for the entire KaAMS project was divided into three major phases designed to capture data that would support initial product development (alpha testing), on-going resources development and implementation planning (beta testing), and analysis of impact on the stakeholders in the learning environment (research-impact analysis). See Figure 2. The diagram below illustrates the flow of alpha, beta, and research processes used for each of the two major products being developed; (1) volcano mission and (2) coral reef mission. This report summarizes overall data collection methods and procedures as well as the findings from the alpha development cycle for Products 1 and 2 - Mission: Studying active lava flows.



**Figure 2. Overall Assessment and Research Strategy Methods**

During the Alpha testing formative and summative evaluation data were collected. With project enhancement in mind, data collected from key stakeholders during the alpha (initial formative development) testing phase included five levels of assessment: (1) reaction, (2) learning gains, (3) performance, (4) education system changes, and (5) impact on the greater society. Research protocols were also tested to assess their effectiveness in measuring the effects of KaAMS materials on teachers, students, and stakeholders in the surrounding community, namely parents. See Table 2.

Table 2: Research questions and assessment

<u>Research Questions</u>	<u>Assessment</u>
How are teachers using KaAMS and NASA resources?	Performance
How are teachers changing their teaching practices (e.g. teaching strategies, incorporation of NASA resources, etc.) over time as a result of using KaAMS and NASA resources?	Performance/ System Change
How are student levels of interest in pursuing science-related career changing over time as a result of using KaAMS and NASA resources?	Learning Gains
How does the use of KaAMS diffuse to the surrounding school system?	Impact on Greater Society

All formative evaluation instruments were administered throughout the alpha testing phases to gather feedback from teachers while preparing for and using the KaAMS materials. Interviews, observations, and focus groups were also conducted at least once per week with teachers and students during the 6-month alpha classroom trials. The summative instruments were administered to teachers at the end of the KaAMS classroom trials and final interviews and focus groups were conducted with teachers and students. The research instruments were administered to teachers and students for pre- and post-test data collection and at an additional 1-month follow-up period for students. Parents were surveyed at the beginning and end of the school year.

**Subjects**

Three middle schools in a rural Pennsylvania school district participated in the KaAMS alpha test classroom trials, East, West, and Dis tant. Six different classrooms from these schools were actively involved. Four were 6<sup>th</sup> grade, one was 7<sup>th</sup> grade, and one was an 8<sup>th</sup> grade honors class. The six teachers who participated provided data about themselves, their classrooms, and success of using KaAMS materials during the alpha testing cycle. Teaching experience ranged from 3 to 23 years; initial preferences for primary teaching strategies included hands-on activities, collaborative activities, role play, and problem-based learning; half of the teachers had moderate success using web resources in their classrooms the other half had not used such resources in their classrooms.

Data were collected from a total of 144 students, 82 were boys, 59 girls and 3 did not respond to the gender question. On average, the students had a moderate level of interest in pursuing science. One hundred and fifty three parents of KaAMS students returned surveys indicating their initial perceptions of science in their school and child’s success and interest in science as well as reporting their highest attained level of education. A majority of the parents did not have college degrees, worked in non-science related jobs, and had a neutral opinion of their child’s school’s science program.

**Measures and Instruments**

*Formative and Summative evaluation:* A series of instruments, observation protocols, and interview protocols were developed to collect formative and summative data from the teachers and students during the alpha testing development cycle.

Teachers were asked to review the KaAMS lesson plans, prepare to use the lesson plans in their classrooms, and complete evaluation surveys after each lesson and at the end of the trial indicating ease of use; value of resources, instructions, and assessment guidelines provided; success of activities; amount of preparation time; descriptions of the classroom activity during KaAMS lessons; and general feelings about using KaAMS for teaching and learning. Teachers were also asked to share feedback during interviews and focus groups including responses to questions such as: What did you like/not like about the supporting website? What parts of the lesson plans did you use - why? What additional support materials did you need to use these materials? What additional materials did the students need? What would you change?

Periodically students were asked, during interviews and focus groups, to respond to questions such as: What did you like/not like about the KaAMS activities? How useful were the internet sites? What was happening in the classroom during KaAMS? What did you learn? and what would have made these activities more useful to you? Observational data were collected several times during the classroom trial that lasted between 3 and 6 months, depending on the classroom teacher. Observation data were collected on how the teachers used the materials, how the students participated in the activities, and artifacts developed by the teacher or students during the KaAMS lessons.

*Research:* The research questions were focused on the teachers, students, and parents. Teachers completed an on-line instrument eliciting background information, preferences for classroom activities, and attitudes toward the use of web resources in the classroom. The instrument was a combination of an attitude survey previously developed and validated for similar research (Koszalka, 2000), a series of questions related to perceptions of their school's ability to support the use of internet technology in the classroom (McCarthy, Grabowski, & Koszalka, 1998), and preferences for teaching styles (Grabowski, Koszalka, & McCarthy, 2000; Koszalka, Grabowski, & McCarthy, 2000). This instrument was administered at the beginning of the classroom trial period and the end (pre-post test).

Data were collected on student level of career interest in science, pre-, post, and 1-month after using KaAMS materials. Student career interest surveys were purchased from the APA. The survey also included a series of questions developed to assess reflective thinking (Koszalka, et al., 2001) and gather demographic data.

Parents were asked to complete surveys at the beginning and end of the school year to assess their perceptions of their child's school's science program. The questions were taken from previous research on measuring parents' perceptions of school programs.

## Results

The initial formative feedback provided guidance in designing support structures for the KaAMS website that helped the alpha teachers connect NASA science to their curriculum and prompt active student involvement, as scientists, during science class. The results from the formative and summative evaluation resulted in: development of enhanced lesson plan structures for the KaAMS website, new content support for teachers that strengthened the relationship between the overall problem scenario and learning activities, further instructions to 'coach' teachers in using PBL, web technology, and activities that prompt student reflection, stronger ties between lesson plans and national education standards and curriculum requirements, and enhanced activities that will better meet kids' needs. The initial research findings from the pilot classrooms were very encouraging. Although caution is warranted in interpreting these results, analysis of the research data collected during the alpha testing cycle showed significant, yet minor changes in teachers, students, and parents after the use of KaAMS in the classroom. Table 3 summarizes research findings in accordance with the KaAMS project research questions:

Table 3. Research questions and Alpha Preliminary Findings

<u>Research Questions</u>	<u>Alpha Preliminary Findings</u>
How are teachers using KaAMS and NASA resources?	Teachers noted the flexibility of KaAMS resources and used them in a variety of ways to enhance or change the way they teach.
How are teachers changing their teaching practices over time as a result of using KaAMS and NASA resources?	Several of the teachers tried new ways of integrating the web and collaborative activities into their teaching; changed their preferred method of teaching and the types of resources they used regularly in their classrooms, and their attitudes toward using web resources in the classroom.
How are student levels of interest in pursuing science-related career changing over time as a result of using KaAMS?	Significant increases in student level of science career interest
How does the use of the KaAMS products diffuse to the surrounding school system?	Parent perceptions of their child's school's emphasis on science, school's ability to provide good science experiences, and use of appropriate science resources were higher at the end of the school year than in the beginning.

We believe that we are providing teachers with a venue and structure for using NASA web-based materials in their classroom in meaningful and contextualized ways that will support student knowledge development in the content and processes of science. Through their high quality materials, NASA can make an impact on science in the classroom, which in combination with KaAMS strategies can change teaching practice, impress middle school kids

with the importance of and strategies for conducting good science—the ultimate goal being to influence career aspirations of these kids toward science.

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## References

- Barrows, H.S. (1986). A taxonomy of problem based learning methods. *Medical Education* 20, 481-486
- Barrows, H.S. (1992). *The tutorial process*. Springfield, IL: Southern Illinois University School of Medicine.
- Duffy, T.M., & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In David. H. Jonasses (Ed.). *Handbook of Research for Educational Communications and Technology*. New York, NY: Simon & Schuster Macmillan.
- Koszalka, T. (2000) The Validation of a Measurement Instrument: Teachers' Attitudes Toward the use of Web Resources in the Classroom. *Quarterly Review of Distance Education*. 1(2), 139-144.
- McCarthy, M., Grabowski, B., and Koszalka, T., (1998). *Web-based Instruction and Learning: Analysis and Needs Assessment*, NASA Technical Publication 1998-206547, NASA Center for Aerospace Information, Hanover, MD.
- Koszalka, T., Grabowski, B., and McCarthy, M (2000) *Web-Enhanced Learning Environment Strategies: Integrating NASA Web Resources into Science Instruction*. AECT 2000 Proceedings. (Sponsored by Research and Theory)
- Grabowski, B., Koszalka, T. and McCarthy, M. (March 2000, March 1999, October 1998, July 1997). *Web-Enhanced Learning Environment Strategies: Handbook and Reflection Tool*, 1<sup>st</sup> thru 11<sup>th</sup> edition.
- Reigeluth, C. M. (1999). *Instructional Design Theories and Models: A New Paradigm of Instructional Theory (Volume II)*. Mahwah, NJ: Lawrence Erlbaum Association
- Savery, J.R. & Duffy. T.M., (1995). Problem-based Learning: An Instructional Model and its Constructivist Framework. *Educational Technology*. 35(5), 31-35.
- Schwartz, D.L., Brophy, S., Lin, X., & Bransford, J.D. (1999). Software for Managing Complex Learning: Examples from an Educational Psychology Course. *Educational Technology Research and Development*, 47(2), 38-59.



## Developing Online Courses: A Human-Centered Approach

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### Abstract

*Designing and building quality distance education is a challenge facing many organizations. Option Six is an independent company building customized e-learning solutions. Over the last two years, the instructional designers and user experience analysts at Option Six worked to help develop a four-stage process for evaluating e-learning courses. The process is built around Donald Norman's (2000) definition of human-centered design. This paper describes the process used by Option Six and outlines the benefits and challenge of human-centered design for distance education.*

### Introduction

Companies and universities are increasingly moving to online delivery for much of their training and education needs. Start-ups, consulting companies, and even universities are touting their ability to deliver quality e-learning to employees worldwide. With so many entities vying for students on a global scale, the issue of quality is becoming an increasing concern. Evaluating distance education is problematic in a number of ways. First, traditional student evaluations at the end of a face-to-face course typically focus on the experience students have with a particular instructor. With most online education, these methods are not valid as a single measure because the instructor's role is only one part of a much broader experience. Technology, the user interface, and the design of content are all keys in understanding the distance learner's experience.

Second, in a face-to-face course, the instructor has the benefit of being able to see the students' reactions to a number of varied teaching exercises. Nodding heads, yawns, and verbal interaction all serve as tacit "formative" evaluation of a course in progress. Distance courses do not have such luxury and not having that interaction can cause severe problems for the students and the instructor (Wang-Chavez & Branon 2000).

Finally, the rapid pace of change in e-learning makes knowing exactly which design principles are "correct" difficult to determine (Williams, Paprock, & Covington, 1999). Donald Norman President of UNext Learning Systems and author of such books as "The Design of Every Day Things" and "The Invisible Computer", has noted that computers are complex and hard to use because we are asking them to do complex tasks (Norman, 2000). Few tasks are as complex as education and finding the "best way" to design online education is likely to be an elusive goal for quite some time. Human-centered development, however, utilizes input from students in the target audience during the earliest stages of development. By having students involved early, unnecessary complexity can be eliminated and learning can be maximized.

### Option Six

Located in Bloomington, IN, Option Six opened in January 2000 as the Bloomington Development Center (BDC) for UNext, Incorporated. In September 2001 the BDC spun off to form a new company, building and designing online courses for a number organizations. The team at Option Six has built courses with faculty from Stanford, Columbia, Carnegie-Mellon, The London School of Economics, the University of Chicago, and Indiana University. Students at a variety of organizations including General Motors, Merrill Lynch, UCLA, and MIT have taken courses built by Option Six team members.

In order to create high-quality courses, Option Six utilizes a team-based approach driven by human-centered design principles. Each team is comprised of members from a variety of disciplines. The point-person for the team is an instructional designer. Instructional designers work with subject-matter experts (SME) to determine the pedagogical strategy for the course. Editors set the tone for the course and ensure consistency in language usage. Visual designers create the look and feel for a course, including graphics, and work closely with multimedia

developers to build interactive components (Flash, video, etc.). User Experience (UE) analysts work with the team to gather data from students in the target audience, which is the core of the human-centered design process.

### **Human-Centered Design Process**

Donald Norman, former President of UNext Learning Systems, defines human-centered design in his book, *The Invisible Computer*:

“It’s a process of product development that starts with users and their needs rather than with the technology. The goal is a technology that serves the user, where the technology fits the task and the complexity is that of the task, not the tool.” (p.185).

Option Six uses an online course development process that is driven by this definition. The process has four primary components that focus development around the student, rather than the technology. Guiding the development of the process is a desire to produce the highest quality online courses with cost-effective user-testing methods. Each phase is designed to maximize resources while minimizing the impact on the overall development timeline.

Each stage in the process has a specific objective. Early stages are designed to catch major design flaws and to identify conceptual difficulties with the material. Large structural flaws in the interface or content tend to be the most expensive and time-consuming problems to correct late in the process. The difficulty is that the early stages of development are the most conceptual and can be somewhat difficult to test with large numbers of users.

The result is a process that starts with expert evaluators (User Experience analysts) conducting design consulting. In the second phase, participatory design, two or three students test components of the course to identify learning issues. The third phase is an accelerated integration test in a laboratory. Finally, an instructional pilot is run with students working in naturalistic setting (work, home, etc.) at a pace that would be expected for the course. At any point during this process it is the data from the students that determines whether the course is ready for the next phase of development. Multiple revisions to materials are anticipated and even expected.

### **Design Consulting**

Design consulting is not a stage in the process but is an ongoing element throughout development. In team meetings, this often means an analyst provides past student testing data to inform decisions. Most importantly, the analyst acts as an objective set of ‘fresh eyes’ looking at a course in early stages of development. The goal of the analyst in this phase is not to replace student testing but to act as a ‘user advocate’ within the design team. Once student testing begins, the design-consulting role includes making recommendations based on user feedback and interim evaluation of product improvements. Several distinct techniques are used to maximize the skills of the analyst in conjunction with student data.

### **Cognitive Walkthrough**

Structured inspection methods are one important way for UE analysts to determine the viability of course organization. Cognitive walkthroughs are a common technique for usability experts and involve following a predetermined path through material to look for potential points of failure (Wharton, Rieman, Clayton, & Polson, 1994). The effectiveness of cognitive walkthroughs is dependent on the expertise of the evaluator and will not necessarily catch all problems (John & Mashyna, 1997). As a part of a larger user-testing strategy, however, they are quite effective for providing an objective eye to inform the design team of major flaws in interface design.

### **Heuristic Evaluation**

Though Option Six does not employ heuristic evaluations for all courses, this method has value when looking at new interfaces or small course components. Heuristic evaluations involve setting metrics for an analyst to use when assessing a course. The technique is less structured than a cognitive walkthrough and allows exploration of the course environment (Sears, 1997). Analysts are looking for aspects of the course that do not meet certain broad standards (readability, ease of understanding, technical problems, etc.) Again, such a technique by itself does not ensure a high-quality course but, as a first-stage pass through the material, it catches many major flaws.

### **Participatory Design**

Participatory design is the first phase of a three-phase testing process. Components of the course are tested with two or three students from the intended target audience. The emphasis in this phase of testing is on high-level conceptual understanding of the course materials. Students work through a combination of early screen designs and paper prototypes of course materials and give continuous feedback to the analyst about whether concepts and procedures are clear and the interface design is usable. As the title implies, the user becomes a co-designer in the design process by providing suggestions for improvement rather than simply identifying problems.

The timeline for a project is built around the idea that development will require multiple iterations based on this early student feedback. Complex content or media often undergo multiple changes in order to ensure students are able to effectively navigate and learn. Many of the worst problems with the material are identified and corrected at this point in the process, saving time and money as the project moves toward completion.

### **Integration Testing**

When development is nearly complete, all of the components are assembled in electronic form and presented as a complete course. Six paid students, who have the same background as the intended target audience, work in a lab environment to take the course. In this phase, there is less emphasis on having the student interact with the design team. The timeframe is compressed (students work six hours per day online) and data is gathered through observation and interviews, rather than participatory design sessions.

In university credit courses, an onsite instructor is also added during this phase to grade assignments and provide feedback to the team about whether students are meeting the learning objectives. The analyst works with observation, interview, and instructor data to develop a profile of overall course effectiveness. Problems with individual parts of the course are noted and the development team makes revisions based on the feedback. Severe problems (e.g., overall course structure is ineffective) are rare at this stage but if any are found, the entire course is retested after revisions.

### **Instructional Pilot Testing**

After the development team is confident all major issues have been resolved, the completed course is uploaded to external web servers and readied for a 'real world' test. Eight students who match the target audience are recruited and paid to work on the course over a realistic timeframe in their own environment. The amount of time varies with the length of time students would be expected to spend on a course. A 30-hour course (roughly one university credit hour) that should take about six weeks to complete would be tested over a three-week period. This timeframe is still slightly compressed to meet development timelines but is much more realistic than in earlier phases of testing.

A User Experience analyst gathers data from telephone interviews, online survey forms, instructor feedback and analysis of online student interaction. The focus is on understanding what potential issues exist for instructors and students as the course is released to paying students. If any development issues are discovered they are also corrected during this phase. Once this phase of testing is complete, the course is ready for release.

### **Lessons Learned**

Using the process outlined above on nearly 30 courses has yielded some interesting lessons on taking a human-centered approach to online course design. Perhaps the single most important lesson was that the process itself involved iterative design. The initial implementation of the human-centered process was too slow and too expensive to be fiscally viable. The process outlined in this paper is the result of much trial and error and additional changes will certainly be made in the future.

### **Benefits**

One lesson learned was that using a human-centered process is key in building high-quality online courses. Subsequent commercial trials and release of a number of courses showed that customers were very pleased with the quality of the courses. Most major technical problems and flaws were discovered prior to release, thus saving money by limiting the need for technical support.

An early model of the process focused on student testing near the end of the development cycle. At that point, however, a great deal of time and effort had been put into programming, graphic design, and course structure.

Major problems were often discovered near the end of the timeline, which jeopardized due dates and cost more money to fix. By making students part of the design team (participatory design phase), most major problems are caught and corrected before too much effort is expended. Interestingly, there are generally only two or three students in this phase, which indicates that it only takes a few users to uncover major problems.

Instructional designers and some members of the development team were initially skeptical of whether user testing could improve the product. One of the unintended benefits was that by seeing their designs being used by students, developers were able to improve their own understanding of how design could be shaped to improve online learning.

## **Challenges**

Creating a human-centered design process involves many challenges. The goal is to ensure a quality user experience with all aspects of an online course. Initially, the User Experience group in the Bloomington office was staffed with usability and information science professionals. It became apparent that guaranteeing a quality experience for online learning would require more than 'traditional' interface design testing. Adding UE team members with instructional design experience and visual design knowledge broadened the group's understanding of how students were interacting and whether they were learning. The first lesson learned was that having a multidisciplinary User Experience group is essential for evaluating online learning (Norman, 2000).

As many organizations are discovering, creating quality e-learning can be an expensive proposition. Finding students in the target audience for business courses (mostly business professionals) required that they be well paid for their time. For lengthy courses, the cost for testing, including facilities, UE salaries, and pay for students can run as high as \$35,000. This cost is minimal for an organization looking to roll out a course to thousands of employees but most universities will not find an acceptable return on investment for this level of testing. In fact, the elimination of potential problems is an investment that can pay big dividends when the economies of scale are large enough.

Another issue with this model is that students are paid for their time. Paid students will obviously have a very different motivation for completing a course than a paying student. This is a difficult problem to overcome when looking for people with specific skills and backgrounds. One potential solution to this problem is to offer businesses 'free' training if employees are willing to provide feedback to the design team. This approach is helpful but can only be used in the latter testing phases when the course is nearly complete.

## **Conclusion**

While the process described in this paper is extremely expensive, there are low cost alternatives to each phase that can improve the quality of online courses. For example, in a university setting, design consulting can be accomplished by having a colleague look at paper prototypes of materials. Even if they do not have time to work through an entire course, students who have taken a face-to-face version of a course make great participatory design subjects. Simply asking a student walkthrough how they would get through an assignment will reveal many flaws in the initial design.

Integration testing is the most problematic phase of the process to conduct on a budget. It is unlikely that most universities can afford to hire students to take a semester-long course before it is taught. One alternative, however, is to continue evaluating the course while it is being taught. This is done implicitly in face-to-face courses and must be explicit in distance courses. Sending a mid-semester survey to ask students how a class is going can provide data to make corrections and improve students' perception of the course (Wang-Chavez & Branon 2000).

Additionally, as a designer builds more courses within a particular domain, the need for testing should decrease. Option Six originally had a much more extensive testing process but as the development teams gained experience, less testing was needed to achieve the same result. Regardless of the level of project, getting input from students is an essential component in quality online course development.

Building a human-centered process for online course development has provided a number of opportunities and challenges. After observing students taking a number of web-based courses the most important conclusion is that no designer can anticipate every issue. By putting students at the center of the design process, a team can proceed with confidence and prevent costly issues with the final product.

## **References**

John, E. & Mashyna, M. M. (1997). Evaluating a multimedia-authoring tool. Journal of the American Society for Information Science, 48 (11), 1004-1022.

Norman, D. A. (1998). The invisible computer: Why good products can fail, the personal computer is so complex, and information appliances are the solution. Cresskill, NJ: Hampton Press.

Sears, A. (1997) Heuristic walkthroughs: Finding the problems without the noise. International Journal of Human-Computer Interaction 9 (3), 213-234.

Wang-Chavez, J. & Branon, R. F. (2000, October). Facilitating web-based instruction: Formative research on improving an online undergraduate business course. Proceedings of the Association for Educational Communications and Technology Conference, Denver, CO.

Wharton, C., Rieman, J., Lewis, C., & Polson, P. (1994). The cognitive walkthrough method: A practitioner's guide. In Nielsen, J. & Mack, R. (Eds.), Usability inspection methods (pp. 105-140). New York: John Wiley & Sons, Ltd.

Williams, M. L., Paprock, K., & Covington, B. (1999). Distance learning: The essential guide. Thousand Oaks, CA: SAGE Publications, Inc.

# USABILITY TESTING OF THE INDIANA UNIVERSITY EDUCATION FACULTY WEB FORMS

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## Abstract

*The usability test team attempted to identify design problems that limit the ability of instructors at the Indiana University to use data entry forms on the School of Education Web site. The forms permit instructors to publish information about themselves and about courses they teach on the School of Education web site. We asked faculty and graduate student instructors to perform typical tasks with the web forms under observation. We requested that the participants describe what they were thinking and feeling as they attempted to perform the task. From these observations, we identified several key design problems that prevented or frustrated the participants. We also recommended solutions to eliminate these problems.*

## Introduction

Over the past couple of years the use of the World-Wide Web (WWW) has increased dramatically. People use the WWW to gather information that informs their day-to-day decision making processes. Organizations of every kind are also making information readily available on the Web. The School of Education at Indiana University has recently decided to make information about course instructors, and information about classes taught in the School of Education available on their public web server (<http://education.indiana.edu>). Instructors can add information to their listing under the faculty/staff directory. Instructors can also add information about classes they teach to the School of Education course catalog. The ability of users to effectively perform tasks with web sites and data entry interfaces is a major factor in the total cost of a computer information system. Poor design can add to the cost of an information system by reducing efficiency, and adding to instructional and performance support costs (Landauer, 1995). Design problems that hinder the ability of instructors to use these forms may also hinder the adoption of these forms by the School of Education community, and also add to the hidden costs of adding these forms.

People use computers in order to achieve goals within a situated context (Suchman, 1987). Usability testing involves observing people attempting to achieve specific goals within a specific context. Frick & Boling (1999) claim that three factors are considered important in the design of a usability test for a web site:

1. The participants must match the intended audience of the web site.
2. The participants must be given authentic tasks that they may be required to perform as part of their use of the web site.
3. The context in which the test is performed should match the actual work context in which the users would perform authentic tasks.

## Methodology

In this research, we focused our data gathering efforts on the target population of faculty and staff of the School of Education. This group also includes graduate students working as Assistant Instructors in the school. The following sections will explain the sample population, the research questions, the process of collecting data, and the process of debriefing and data analysis.

## Population Sample

We used a convenience sample in order to try and get a number of participants from our target population with medium to low HTML and web skills. We felt that with a small population sample of 8-10 participants, and

participants with less web experience would accentuate problems in the web forms interface we were testing. In addition to seeking participants with low web skills, we also sought to get participants from many different departments. We also tried, without success, to get an even gender representation in our population sample. Table 1 shows information about the nine participants in our usability tests.

*Table 1. Participants in the Usability Test*

Participant	Position	Skill Level	Department	Gender
Participant 1	Research Faculty	Low	Dean's Office	Female
Participant 2	Faculty	Low	Early Childhood	Male
Participant 3	AI	Medium-low	Language Education	Male
Participant 4	Faculty	Low	Instructional Systems Technology	Male
Participant 5	Faculty	Low	Educational Leadership and Policy Studies	Male
Participant 6	AI	Medium-low	Math Education	Male
Participant 7	Faculty	Low	Special Education	Male
Participant 8	Faculty	Low	Educational Leadership and Policy Studies	Male
Participant 9	Faculty	Low	Secondary Education	Male

## Research Questions

There are two main questions that we investigated as part of this project:

1. What are the design problems that prevent or discourage faculty and staff from using the web forms to add/update their online profile information?
2. What are the design problems that prevent or discourage faculty and staff from using the web forms to add/update a syllabus link to a course in the School of Education course catalog?

These are both important questions to address because if the faculty and staff cannot easily update this information, then there is a high likelihood that they will not take the time to add/update their personal information and course information. This could potentially result in frustration by users seeking information using the school's web pages.

## Data Collection

We observed the participants performing the following two tasks:

1. Add/update their personal profiles to the School of Education faculty and staff directories on the Web.
2. Add a syllabus link to a course in the School of Education course catalog on the Web.

We tried to make the tasks as *authentic* as possible by

- Having the participants perform the tasks in the environments where they would normally perform the tasks (e.g., their offices or public computing labs).
- We contacted the participants ahead of time and asked them to have a copy of their syllabus (or know the link if already online) ready to use in the testing. This allowed the ones who came prepared with their own syllabi, to post their syllabi to the web for an actual course. (We also had a copy of a syllabus on disk in MS Word format that a couple of individuals who had forgotten used. In these cases, they posted to a test course R999 that was set up by the Web director.)

We also swapped the order that different participants were asked to do the two tasks in order to try and eliminate overlooking problems that might occur by doing the tasks in different orders.

We asked the participants to "think aloud" while they were performing the tasks. Meanwhile, the observers took notes of difficulties and problems they were having. We also timed each of the tasks.

## Data Analysis

After all of the usability testing observation sessions had been completed, the four members of our project team met to debrief and analyze our findings. We grouped similar problems together and recorded a short description of the problem along with the number of participants that reported the problem. We then ranked the problems according to the following criteria:

1. **Most critical:** Problem prevented the subject from accomplishing the desired task or the subject reported high levels of frustration in regards to this problem.
2. **Critical:** Problem resulted in confusion or misdirection that did not prevent the subject from accomplishing the desired task.
3. **Not-critical:** Problem was reported as confusing or undesirable but there is no urgent need to fix this problem to insure functionality.
4. **Low-priority:** Problem should be examined on a case-by-case basis.

We then linked the problems to specific stages in the process at which the problem occurred. We also provided recommendations for fixing the problem, as well as recommendations for re-designing the site as a whole.

## Findings and Recommendations

### Task 1: Add/Update Profile

In our usability test we asked the participants to add or update their personal profile. The personal profile is published with the staff and faculty directory, and is linked to entries in the course catalog. Figure 1 shows the task of adding/updating a profile broken down into six sequential steps. The web forms interface consists of three separate pages. The first page (Demographics) asks for the instructor's name and email address. The second page (Contact Info) asks for office location and telephone number. The third page (Personal Info) asks for a large amount of information including job title, department, home page and optional fields for more information and links to other web sites.

Most participants experienced problems on the Personal Info page. Participants reported frustration with the large size of the page and the variety of information requested. Some participants also reported problems interpreting instructions and anticipating how the information they entered would be displayed.

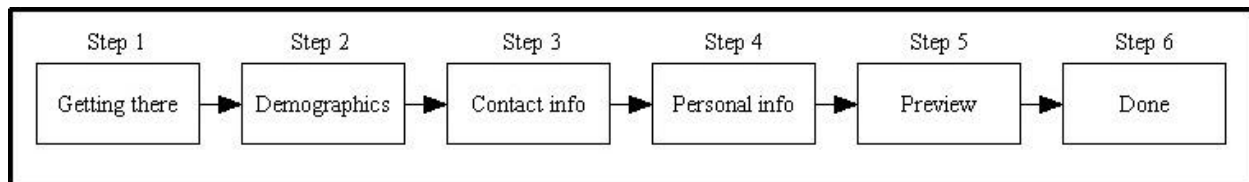


Figure 2. The Six Steps Required to Complete the Task of Adding/Updating a Profile

#### Step 1: Getting to the Profiles Page

This section of the report deals with challenges that the users had in finding the web forms that they could use to add or update their personal profiles. Table 2 outlines our findings and recommendations for improvement of this step in the process.

Table 2. Findings and Recommendations for Getting to Profile Web Forms

Findings (Observations)	Rating	Recommendation
Three participants experienced some difficulties in finding the first profile web form page. These individuals followed the path that took them to the Faculty and Staff Directory. They would go to their existing profile and from that page (the old profile formats) there was not a link to update their individual profile. Although there was a link to update profiles from the Faculty and Staff Directory page it was not easy for these participants to locate.	1	The impact of this problem may be reduced by making the link on the Faculty and Staff Directory more obvious. Currently the only word that is linked is the word "here" that is embedded in the middle of a couple of lines of text. The link text could be changed to something like "Add/Update Your Profile" and placed on its own line.
Three participants expressed uncertainty about	3	Try re-writing documentation to eliminate ambiguity.



which password they should use in order to update their profiles. Only one participant actually typed in the wrong password and had to go back and re-enter another password.		Unfortunately this problem needs to be addressed by University Information Technology Services and not the designers of the web forms.
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### ***Step 2: Adding/Updating Demographic Information***

This section of the report deals with challenges that the users had in adding or changing their name and email address. Table 3 outlines our findings and recommendations for improvement of this step in the process.

*Table 3. Findings and Recommendations for Adding Demographic Information*

Findings (Observations)	Rating	Recommendation
Two participants discovered that the middle name did not appear in the final profile. One of the individuals uses his middle name as his preferred name, and ended up getting around the system by placing his middle name in the first name slot.	2	Don't ask for a name that will not be included on the profile page. Both of the following solutions might be acceptable: <ul style="list-style-type: none"> <li>• Include all three names in the profile page.</li> <li>• Have a preferred name slot and a last name slot.</li> <li>• Have one text blank labeled "Full Name to appear in profile"</li> </ul>
Two of the participants were confused by the wording on the submit button on this page which read, "Save the data in this form and add your office location information." They didn't realize that the "and add your office location information" part of the text was referring to what they would do on the next page.	2	Our recommendation for this option is to add a <b>wizard style navigation</b> header and footer to each of the profile pages. (This recommendation will also address several other findings from the usability test.) For details on this recommendation, see the General Recommendations for Add/Update Profiles Pages section of this report.  If the wizard style navigation recommendation is not taken, the wording of the button could be changed to something like, "Save the demographic info and go onto the next step."

### ***Step 3: Adding/Updating Contact Information***

This section of the report deals with challenges that the users had in adding office location and contact information to their personal profile. Table 4 outlines our findings and recommendations for improvement of this step in the process.

*Table 4. Findings and Recommendations for Adding Contact Information*

Findings (Observations)	Rating	Recommendation
One individual didn't realize that when he updated his room number he also had to click on the corresponding radio button. (Incidentally, if the radio button is selected without entering a room number in the text box, you are taken to a blank screen which says, "Your form was Processed" and nothing else.)	1	The form could be simplified by having a box in which the room number could be placed and instructions to leave the box empty if they don't have a room.  The current radio buttons could be kept and JavaScript could be used to select the appropriate radio button when a number is entered in the text box.

### ***Step 4: Adding/Updating Personal Information***

This section of the report deals with challenges that the users had adding personal information about themselves and what they do in the School of Education. Table 5 outlines our findings and recommendations for improvement of this step in the process.

Table 5. Findings and Recommendations for Adding Personal Information

Findings (Observations)	Rating	Recommendation
Five of the participants reported skipping the optional "More about me" fields because of perceived complexity of the instructions for entering HTML. They were not able to add information to their profiles that they wanted to because they felt that it would be too complex for them to do it.	1	Simplify the task by using formatted plain text only. OR Give radio button choice for each text box indicating "Plain Text (default)" or "HTML" like in AltaVista Forum (AVF)
Participants didn't seem to understand if text boxes would be WYSIWYG or HTML. In one case a participant entered multiple titles separated by a carriage return and was surprised to see them squashed together on the final profile. (There are inconsistencies - for example the "What You Do" section converts completely to HTML with no hard carriage returns while the "More About Me" section allows links to be added but also recognizes carriage returns.)	1	Simplify the task by using formatted plain text only. OR Give radio button choice for each text box indicating "Plain Text (default)" or "HTML" like in AVF OR Use the server-side CGI script to check text block for any HTML tags. If there are tags format as HTML otherwise format as plain text.
Three participants were a little confused by the text box labeled "Name of your office/unit. At least one filled in the name of his office even though he had checked the box for the office above. The indentation of the fields relative to the other options seemed confusing to the participants. People tended not to read the * instructions carefully.	2	Align all choices equally. Have a checkbox directly below the others followed by a blank text box for them to enter their office/unit if it is different. A * could be placed at the end of the text box and another * could be placed below with instructions about how to enter the URL for the "other" unit.
Two participants expressed uncertainty about what to put into the section labeled "What You Do." The concern was whether this was just for faculty/staff job responsibilities or if it could contain other kinds of information too.	2	This problem could easily be solved by providing more explicit guidelines about what should go in this area. Also, being able to see an example of a typical profile might allow them to see where it would be most appropriate to stick different pieces of information about themselves.
It was our observation that participants were overwhelmed with the amount of information being requested on this page.	2	This problem could be solved by using the <i>wizard style navigation</i> (see description in section General Recommendations for Add/Update Profile Page). Using this system this step could easily be divided into several more simple steps.

**Step 5: Previewing and Publishing a Profile**

This section of the report deals with challenges that the users had in previewing and publishing their profile. Table 6 outlines our findings and recommendations for improvement of this step in the process.

Table 6. Findings and Recommendations for Previewing and Publishing a Profile

Findings (Observations)	Rating	Recommendation
Three of the participants considered clicking the "Update this profile" link that is embedded into the profile preview instead of the publish preview button. This generally happened because they were scrolled down to the middle of the page where they could not see the buttons and the link text sounded like it would do what they wanted to do.	1	To solve this problem we suggest that changing the wording of the link text from "Update this profile" to something like "Start the update profile wizard" or "Go to the Update Profile Pages." We feel that a different wording like this will be harder to confuse with publishing or actually saving the updates.
Three participants in the usability test did not	1	Doing something to make the reload reminder obvious,

remember to click the reload button after going back to make changes to their profiles, even though the first line of instructions reminded them too. In general, they read the instruction block the first time they arrived at the page but did not re-read it on subsequent visits.		even without reading the instruction block over, could solve this problem. A couple of possibilities might be changing the color of the word "reload" and making it bold. Or the word reload could be made to blink on and off. OR A server-side solution might be to write the temporary profile to a file with a different name each time - perhaps <timestamp>.html. When the user publishes the profile the temporary file is written and deleted. OR The tradeoff might make using a meta-tag that automatically forces the page to be reloaded every time worth it.
Several participants commented that it would have been helpful to be able to see examples of profiles or even preview their own profiles during the process instead of having to wait until the very end and then go back to make changes at the appropriate step.	2	This problem could be taken care of by implementing the solution that is mentioned under <i>wizard style navigation</i> section later in the report. Under this system, the users could preview their profile at any step through the process.
One individual didn't readily see the information entered in the "More About Me" fields on the profile preview. He finally found them below the map and said that he felt like they should have belonged above the map.	3	Move the link to the "More about me" entries from the middle of the demographic information to a more prominent location.

### Step 6: Post-publishing steps

This section of the report deals with challenges that the users had with navigational steps required after the profile is published on the web. Table 7 outlines our findings and recommendations for improvement of this step in the process.

Table 7. Findings and Recommendations for Post-Publishing Steps

Findings (Observations)	Rating	Recommendation
One person exited the web browser directly after publishing the profile because he was following the red highlighted text at the bottom of the page literally. Then he started his web browser right back up.	4	The wording of the message could be changed to not imply that the browser should be closed right then, but that it should be closed before they leave the machine.
One person indicated that he felt like there were too many link options on the last page. He felt that it was confusing.	4	We are not sure that this is a problem that needs fixing.

### General Recommendations for Add/Update Profile Pages

We have one general recommendation for the profile submission forms. This is a general recommendation because it addresses several of the findings observed in the usability testing and mentioned earlier in the document. Our general recommendation is to change the navigation system to a "wizard style navigation". What we mean by this is explained in the following section.

### Wizard Style Navigation

A "wizard" is a tool that helps to step a person through a linear process by displaying the current position in the process as well as providing controls to move forward or backwards in the process. We think that including a

wizard navigation header and footer on each page would be an ideal way to address many of the issues mentioned earlier in the findings. The wizard navigation would graphically outline the steps and indicate where the person is in the overall process. It should contain buttons to allow the user to progress forward through the steps as well as backwards through the steps. Ideally, the navigation bar would also have a preview button and a publish button which would allow the user to preview or publish the current state of the profile at any time in the process.

## Task 2: Add/Update Syllabus Link to Course Catalog

This task tests web forms that allow instructors to publish information about a course they teach on the School of Education course catalog. The web forms give instructors four options for entering a course description or syllabus:

1. Enter a syllabus as HTML-formatted text.
2. Enter a syllabus as plain text with carriage returns.
3. Enter a link to an existing syllabus on the WWW.
4. Enter a link to Oncourse, a web-based academic conferencing system.

Seven participants tried the HTML path. One participant tried the Plain Text path and two tried the syllabus link path. No individuals tried the Oncourse path. One participant tried multiple paths in order to achieve good results.

The most critical problem we found was that out of seven participants who attempted to enter HTML-formatted text, six found that following the instructions did not produce the desired results. The instructions on the web form direct the participants to convert their syllabus from a word processor document to HTML text using Microsoft Word 97, then paste the resulting HTML-coded text into a web form text box. In most cases Word 97 failed to produce readable HTML-formatted text.

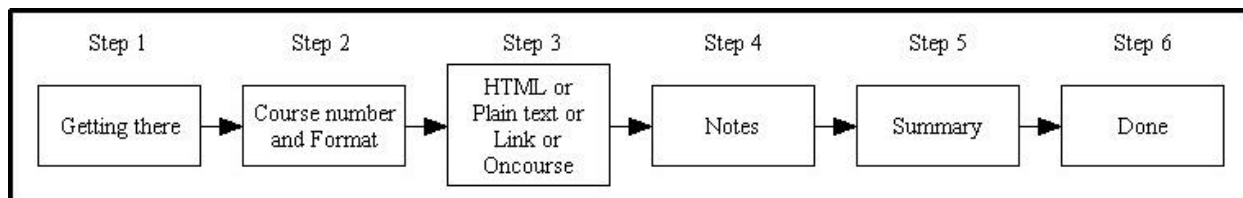


Figure 3. The Six Steps for Adding an Entry to the Schedule of Classes

### Step 1: Getting To the Add or Update a Syllabus Page

This section of the report deals with challenges the users had finding the web forms that permit them to add a course entry to School of Education web site. Table 8 outlines our findings and recommendations for improvement of this step in the process.

Table 8. Findings and Recommendations for Getting to the Add a Course Web Form

Findings (Observations)	Rating	Recommendation
The link text (on page updates.html) indicates that you can <b>add</b> a syllabus link but not update a syllabus link.	2	Change the link text to say "Add/Update . . ."
The link text to enter the forms from the course catalog is somewhat confusing. It states "Add/Modify your course web site."	2	The text should be changed to read something link "Add/Modify syllabus link for this course" or something similar. In addition the text at the top of the course catalog table should be made clearer by changing it to "Syllabus Link(s)" instead of just "Link(s)"

### Step 2: Entering a Course Number and Choosing a Format

This section of the report deals with challenges the users had entering a course number and choosing a syllabus format. Table 9 outlines our findings and recommendations for improvement of this step in the process.

*Table 9. Findings and Recommendations for Entering a Course Number and Choosing a Format*

Findings (Observations)	Rating	Recommendation
Four participants typed a lower case letter first for the course number.	2	Use server-side CGI to set the case of the letter rather than forcing user to do it.
When the participants got the error message for typing in a lower case letter or not selecting a radio button the error message is incorrect and says "Click the back button and enter the <b>filename</b> in CAPITAL letters."	2	Check all error messages and make sure that they are appropriate for the error. The two errors mentioned should have different error messages and the message for the first error should read "Course Number" instead of "filename."

**Step 3.a: Adding an HTML-Formatted Syllabus**

This section of the report deals with challenges the users had adding an HTML-formatted syllabus to the School of Education web site. Table 10 outlines our findings and recommendations for improvement of this step in the process.

*Table 10. Findings and Recommendations for Adding an HTML Formatted Syllabus*

Findings (Observations)	Rating	Recommendation
Six participants followed the instructions to convert a word-processed document to HTML and didn't get results that they were satisfied with. (Tables and tab-formatted documents notably had problems and participants didn't have skills to make changes.)	1	See general recommendations below.
Five of the participants complained about being forced to use MSWord. Their word processor of choice was WordPerfect.	1	Same as above.
The forms don't allow the user to edit a syllabus that has been added. To make one change to the syllabus they must edit their Word document and go through the whole conversion process again. (This can be painful for just a spelling change or something.)	1	Allowing to upload syllabi in their original format would solve this problem. OR Load the syllabus HTML text into the text box when a syllabus already exists.
Five individuals commented on the reference to the "Title Box <b>below</b> " when the title box was really above	2	Change the text to read "above" instead of "below."
Following the HTML instructions was difficult because the users had to switch back and forth between the word processing window and the browser window. Each time the users had to re-find where they were in the process. (One individual skipped the step of changing the word processor to "view html source" and therefore ended up in the end with a bunch of words all scrunched together - spaces removed.)	2	Suggest in the instructions that the user print out the instructions to reduce the chances of skipping steps.

**Step 3.b: Adding a Plain Text Formatted Syllabus**

This section of the report deals with challenges the users adding a plain text syllabus to the School of Education web site. Table 11 outlines our findings and recommendations for improvement of this step in the process.

*Table 11. Findings and Recommendations for Adding a Plain Text Formatted Syllabus*

Findings (Observations)	Rating	Recommendation
One participant pasted plain text copied from a	2	Strengthen wording in instructions to indicate that most

word-processing document into textbox but was unsatisfied with results.		text formatting will be lost.
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***Steps 3.c: Adding a Link to an Existing Syllabus Elsewhere on the WWW***

This section of the report deals with challenges the users had adding a hypertext link from the School of Education course catalog to an existing syllabus elsewhere on the WWW. Table 12 outlines our findings and recommendations for improvement of this step in the process.

*Table 12. Findings and Recommendations for Adding a Link to an Existing Syllabus Elsewhere on the WWW*

Findings (Observations)	Rating	Recommendation
Participant was unable to find syllabus published on School of Education web server prior to installation of new web forms.	3	Provide suggestions for finding URL of published syllabus. Also consider providing links to Indiana University web search tool.

***Steps 3.d: Adding a Link to Oncourse***

This section of the report deals with challenges the users had adding a hypertext link from the School of Education course catalog to Oncourse, an online academic information system developed by Indiana University Information Technology Services. No participants selected this option.

***Step 4: Adding Additional Notes to the Course Entry***

This section of the report deals with challenges the users had adding additional notes to the course entry. Table 13 outlines our findings and recommendations for improvement of this step in the process.

*Table 13. Findings and Recommendations for Adding Additional Notes to a Course Entry*

Findings (Observations)	Rating	Recommendation
Four of the users did not even enter anything in the notes block because they were just not sure what kind of information should go there. One individual put several paragraphs about himself in the notes area.	2	The instructions should be changed to indicate what kind of information should be included in the notes. AND An example or preview might help.

***Step 5: Viewing Summary Information***

This section of the report deals with challenges the users had interpreting summary information provided about a course entry. No problems were observed with this step.

***Step 6: Post-Publishing Steps***

This section of the report deals with challenges the users had viewing updated course entries after they were published. Table 14 outlines our findings and recommendations for improvement of this step in the process.

*Table 14. Findings and Recommendations for Post Publishing Steps*

Findings (Observations)	Rating	Recommendation
Participant went back through web forms to make changes. Participant then tried to view changes but failed to reload web page.	2	Add tag to web pages to force the course schedule and syllabus to reload if possible.

**General Recommendations for Adding or Updating a Course Entry to the School of Education Course Catalog**

Converting a word-processing document to HTML text caused serious problems for all but one of the individuals that attempted the process. This procedure resulted in four different types of problems affecting a large

percentage of our participants. We do not feel we have enough information to properly recommend a solution to this problem. Possible solutions may include providing the ability to upload word processing documents, conversion of word processing documents to Adobe PDF, or providing technical assistance.

Participants also reported problems with the instructions provided on the web forms and with labels of text fields. We recommend that the instructions and descriptive text be edited to correct errors and reduce ambiguity.

## Limitations

Three of the main limitations to our findings involve the selection of our participants:

1. Only one of our participants was female.
2. Only two of our participants were Associate Instructors.
3. We did not recruit participants that had high levels of computer experience.

We attempted to recruit more women and associate instructors. However we were unable to arrange test sessions with most of the women and associate instructors we contacted. It is possible that having greater representation in both of these groups may have added insights to the information we gathered. We also did not recruit participants with high levels of computer experience. We deliberately selected a convenience sample of individuals with low to moderate computer experience in order to maximize observation of design problems experienced by novice users. As a result, we don't make any generalizations regarding the ability of instructors in the School of Education to use these forms.

Additionally, none of the people that we did the usability testing with had done either of the tasks before. Therefore, our tests did a good job of testing what a novice to the system would do in adding information to the system, but didn't explore what challenges would be faced by someone who had already entered data and just wanted to make a small change (e.g., a new phone number, link, or spelling correction/date change to syllabus). We have a hunch that there may be additional problems that surface when this aspect of the system is tested.

Some other problems came out during testing. None of the participants tried to add an Oncourse syllabus to the course catalog. Although the process is very similar to adding a syllabus link, some testing of this should be done to ensure usability. Several participants also reported that they would have abandoned some steps in the process if they had not been participating in a usability study. Participants reported that being observed encouraged them to tackle problems that would have led them to give up.

## Conclusion

We found multiple problems with the design of the web forms that hindered or prevented our participants from successfully completing these tasks. Re-designing the web forms in order to reduce or eliminate these problems is in our opinion essential to ensuring the adoption of these web forms within the School of Education. The designers of this web site should address the following problems in future versions of the web site:

1. The recommended procedure for adding an HTML-formatted syllabus to the School of Education web site fails to produce satisfactory results. The designers should find tools that produce reliable results, or eliminate this option. The School of Education may need to make organizational changes such as employing specialists to assist instructors in preparing electronic versions if this feature is desired.
2. The Personal Information page causes problems for users due to its length and complexity. At a minimum the form should be separated into two pages, one for required information and one for optional information. In addition the designers should make sure that all multi-line text fields handle carriage returns properly.
3. The designers should add navigational elements to the web forms that provide the user with indications of what steps they have completed and what steps they still need to complete.

## References

- Frick, T. W., & Boling, E. (1999). *Practical Web Design*.
- Landauer, T. K. (1995). *The trouble with computers : usefulness, usability, and productivity*: Cambridge, Mass. : MIT Press.
- Suchman, L. A. (1987). *Plans and situated actions : the problem of human-machine communication*: Cambridge ; New York : Cambridge University Press.

# GUIDELINES FOR CONVERTING EXISTING COURSES INTO WEB-BASED FORMAT

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## Abstract

*This paper reports research in progress. It presents information in the literature on converting traditional courses into Web-Based format. The paper is divided into four parts. The first part makes an introduction to Distance Education (DE) and Web-Based Instruction (WBI) which combines features from both face-to-face classroom instruction and DE. The second part discusses current Instructional Design (ID) models for WBI. In the third part, findings from the literature on converting existing courses into Web-based format are discussed. This part includes information in the following categories: How to start the conversion to the WBI, student and instructor support, design issues, interaction among people, and assessment. In the last part, a model proposing an orderly process for converting courses into Web-Based format will be explained.*

## Introduction

While organizations and schools (K-12, colleges, and universities) have been using the Internet to distribute information for a long time, the implications for the instructional design and delivery of instruction over the Internet have not been sufficiently explored. Many instructors are given the task of converting existing courses into Web-based format. However, since very little has been written on this subject, instructors are left to learn the conversion process by trial and error (Lightfoot, 2000). As a result, instructors might create WBI courses equal to electronic page turning by following the traditional ID models and utilizing old methods of face-to-face delivery. This literature review will unearth the guidelines for converting existing courses into Web-based format. These guidelines will help the practitioners by offering a systematic way for conversion thus eliminating trial and error.

## Definitions

In the literature, I came up with such terms as Internet-based training, Internet-based instruction, computer-based distance education, Web-based learning, Web-based distance education, and Web-based instruction. For the sake of simplicity, and to prevent confusion, I will use Web-based instruction (WBI) through the text.

## Delivery of Education

Delivery of the education has changed throughout the history. Today, there are two main delivery methods: Face-to-face education and distance education (Shave, 1998).

In the industrial age, formal education system followed the factory metaphor. A campus (factory) was built and the students and teachers (employees and management) arrived at it and worked there (Shave, 1998). In this system, main delivery method for instruction has been face-to-face.

In the traditional face-to-face method the instructor can allocate time for the learners, learners can interact with other learners and with the instructor, and immediate feedback is possible. However, learning should occur at a particular time and place. Besides, interaction between the people in the learning process is difficult outside the classroom.

## Distance Education (DE)

DE as a method of delivery of instruction is a promising technology, which can eliminate these problems of face-to-face method. "The term distance learning or distance education refers to the teaching learning arrangement in which the teacher and the learner are separated by geography and time." (Williams et. al., 1999).

Keegan (1980) characterizes DE with six key elements, one of which is the use of media to link teacher and learner. Different communication and media technologies can provide the link between teacher and learner.



Examples include television, computer transmission, audio or computer conferencing, videocassettes or discs, and correspondence (Heinich et. al., 1999).

In order to describe the media technologies used in DE, “The 4-Square Map of Groupware Options” model developed by Johansen et. al. (1991) provides a convenient way. This model is developed on two basic configurations that teams must overcome as they work: time and place. Based on these configurations, the 4-Square model classifies four types of technologies that support the group process. They are:

- Same time/different place
- Same place/different time
- Same time/same place
- Different time/different place

### **Web-Based Instruction (WBI)**

WBI is a type of technology that is in the different time/different place category. The most valuable asset WBI brings to the DE field is that it allows the flexibility for learning to be occurred at any time and any place (Tipton et. al., 1998). With this flexibility, WBI can offer academic programs to a larger potential audience, which Ehrmann (1990) refers as the New Majority. These people do not have time to a full-time study on campus. For this reason, traditional face-to-face format cannot serve them. WBI may provide instruction to these people at times and places more appropriate to their lifestyles.

Many colleges and universities today are restructuring their existing courses to be offered via the Internet to target the New Majority (see, for example, Bichelmeyer et. al., 2000). As the demand grows, the number of WBI providers will increase. Besides, the number of students who have been using the Internet for communication and research is increasing in vast amounts. For this reason, it might be possible that non New Majority students also may jump to the WBI bandwagon, thus making the market even bigger.

WBI not only provide any time and anywhere delivery of education, but it also does so as effective as face-to-face education. Several researchers conducted experimental studies to compare the student performance of Web-based versus traditional class format (see, for example, Schutte, 2001, and Jones, 1999). They found higher scores for WBI or no significant difference between the two conditions. Besides the effectiveness, some course evaluations showed that WBI courses were appealing to students and students were positive about WBI (see, for example, Friedrich, 1999, and Ingebritsen et. al., 1998).

There are some other advantages of WBI. They are potential to reach a global audience (Duffy, 1992), support for multiple learning styles (Ingebritsen et. al., 1997), lower development and operating costs (Kuchinke et. al., 2001), and being a diverse information resource (McManus, 2001).

We can find disadvantages with every new innovation however and WBI is no exception. Some of the problems listed in the order of most cited are limited bandwidth (McManus, 2001), access to hardware and Internet (Shave, 1998), social isolation (Lichty, 1997), and reliance on learner (Ingebritsen et. al., 1998). Another problem lies in the conversion of delivery of instruction from face-to face to online method.

### **Instructional Design Model for WBI**

The purpose of an Instructional Design (ID) model is “to convey key concepts and processes to be included in a particular approach” (Molenda et. al., 1996). Models tell us the critical success factors to instructional design. To be more specific, an ID model tells us what to do and when to do it, and it barely tells how to do it. Molenda et. al. (1996) point to the importance of an ID model by this example: “...experience leads the expert away from the cookbook and toward improvisation. But for the apprentice chef, the cookbook is the vital link to maintaining quality and consistency from day to day.” The ID model is the cookbook that will address these concerns for instructional design.

There seems to be a lack of an ID model and conversion model for WBI. Since the Internet has not been used very long as a means for instruction, currently there are no time-proven models for WBI (Edwards, 1999). What makes this worse is the “misconception that the digital media is able to translate printed matter directly to the screen” (Lichty, 1997). Following this misconception, many instructors and designers have created ineffective WBI courses which do not utilize the opportunities Internet has offered.

Computer mediated communication supports the new paradigm of knowledge-building model for the delivery of learning. Traditional education is based upon a paradigm generally called “knowledge reproduction model.” The components of this model are verbal lecture, printed handouts, drill and practice sessions, structured

classroom activities, and office hours (Lightfoot, 2000). In this model, students are seen as passive learners. The purpose of teaching is to transfer static body of knowledge from its source to the student.

According to Imel (1997) the most important distinguishing characteristic of WBI is the emphasis on instruction and not just on information delivery. When information delivery is the basic concern, WBI will resemble computer-based instruction, which has been criticized as being restrained by behaviorist learning theory. WBI should be designed by basing it upon the cognitive-based theories of learning, where learners purposefully interact with the environment, actively participate, thus following the knowledge-building paradigm.

### **Current ID Models for WBI**

Long ago, after the old king died and the prince was crowned, the crowd used to chant, "The King is dead... long live the King" to acknowledge the passing of the old king and the acceptance of the new one. For WBI, the old ID models no longer work. The king is dead. It is time to look at new models of instructional design (Hisey, 2000).

However, when we take a look into the current ID models for WBI identified by Edwards (1999), we witness that the instructional designers lament for the old king. The ID models for WBI used by practitioners resemble the old models. Current WBI models in the literature are Reeves and Reeves' model, Ritchie and Hoffman's model, and Duchastel's model.

Reeves and Reeves WBI model includes ten components for learning on the World Wide Web (WWW) called dimensions. These dimensions are (1) pedagogical philosophy, (2) learning theory, (3) goal orientation, (4) task orientation, (5) source of motivation, (6) teacher role, (7) metacognitive support, (8) collaborative learning (9) cultural sensitivity and (10) structural flexibility (Edwards, 1999).

Ritchie and Hoffman's WBI model adapts traditional instructional design principles into WBI. These are: motivating the learner, explaining what is to be learned, helping the learner recall previous knowledge, providing instructional material, providing guidance and feedback, testing comprehension, and providing enrichment or remediation (Edwards, 1999). In this form, this model resembles Gagne's nine events of instruction.

Duchastel's WBI model (Duchastel, 1996) proposes innovative changes to the traditional instruction model. He defines several functions in his model for WBI. He contrasts these functions with the traditional ones found in traditional teaching. These functions are specifying the goals to be pursued by learners instead of specifying content to be learned, evaluating learners at the task level instead of relying on standard testing, having learners study and work cooperatively and collaboratively instead of studying alone, producing knowledge rather than communicating it, and creating global learning communities instead of restricting programs to local interactions.

Edwards (1999) identified five recurring themes common between these three models. They are need for clear goals, including collaborative learning teams, incorporating motivational aspects into WBI, turning instructors into facilitators who provide guidance and feedback, and facilitating the production of knowledge and the development of skills in WBI.

He also developed a model for WBI based on these themes. He aimed his model specifically for higher education and adult learners, but he also added that elements of this model could be applied to any type of WBI. The basic foundations of Edward's WBI model are goal-oriented, motivational provisions, student-centered, guidance/feedback provisions, collaborative learning strategies, and project-based.

It is difficult to state that the models identified by Reeves and Reeves, Ritchie and Hoffman, Duchastel, and Edwards are design models. Their ideas include useful elements which make up successful WBI courses, but the claimed models do not tell us what to do and when to do it during the design of WBI. Therefore, there is a need for a more robust ID model for WBI.

### **Findings from the Literature on the Current Practices in WBI**

I will summarize the practices of WBI from the literature under the following categories: How to start the conversion to the WBI, student and instructor support, design issues, interaction among people, and assessment. I found these categories by blending existing model components and by putting together common practices followed by the practitioners.

Imagine yourself driving without a road map in a remote area, which you have never been before. How would you find your way to your target? One approach would be trial and error. You could take a highway exit you strongly believe will bring you to your target. Or, you could stop by at a gas station and ask to the clerk. Whatever approach would be taken, finding your target without a map would cause you to lose valuable time and resources.

Instructional designers and instructors trying to convert their courses into WBI format without a time-proven solid model are similar to those drivers trying to find their target in a remote area without a road map. Practitioners follow several approaches in the conversion process.

Practitioners usually tend to start the conversion of instruction to Web-based format by prototyping the WBI at informational level (Lightfoot, 2000). To restate it another way, designers usually develop a site first as a supplement to the in-class course. Shave (1998) proposes four levels to use the Internet as part of a course. They are:

- **Informational (Level 1)** in which the Internet is used to provide information to students that is relevant to the administration of the class. Example information items are timetables, syllabi, and class notices.
- **Supplementary (Level 2)** in which additional resources are provided for students. Resources may include additional references and useful hints.
- **Dependent (Level 3)** in which the major components of the course are on the Internet and students need to access these as part of the course.
- **Fully On-line (Level 4)** in which the entire course and activities are on the Internet.

Friedrich et. al. (1999) go on to say that even a simple online syllabus can be advantageous for both the instructor and the student in the conversion process. These authors developed a Web site, which supplemented their graduate course in statistics and measurement. What included on this site were course syllabus, course procedures and policies, course schedule, individual units, and resources. Shotsberger (1996) surveyed existing efforts at using WWW for instructional purposes and found that most existing sites were intended as an adjunct to the classroom.

Modeling the existing Web-based courses is another start point for conversion. Modeling helps to overcome limited time and limited experience problems. Friedrich et. al. (1999) derived the basic site structure for their WBI from existing Web courses that they browsed. Ingebritsen et. al. (1998) modeled their online lectures after a face-to-face lecture experience.

Student and instructor support is an important component in WBI. Duffy (1992) states that a WBI program will not function without proper support. Student support may be in the form of an orientation. Instructor support may be provided by offering technology training to the faculty, and by creating ID teams and technical support teams.

When I started studying at Indiana University, I got an orientation from the university, from the Instructional Systems Technology (IST) department, from the education library, and etc. These orientations introduced me to the environment, to the resources, and to the important things I needed to know to be successful in my program. WBI is a new learning environment for many students and such an orientation will not only be an icebreaker to the learner but it will also show deficiencies in the WBI to the designers before actually it starts.

Kuchinke et. al. (2001) stated that eliminating as many technological barriers as possible before the beginning of the actual WBI is critical to a successful start. To do this, they offered an online tutorial and practice sessions two weeks prior to the first course in their WBI. Their tutorial included such components as practice sessions and assignments. The tutorial helped the students become proficient with all hardware and software requirements before beginning of the course. Friedrich et. al. (1999) recommends that universities must support the students and train them for online courses. This training shall be in the form of a workshop including such topics as how to take an online course, how online courses are different from classroom based courses, what skills are needed to be good online students, and etc.

A lot of studies mentioned lack of instructor experience in WBI as a problem (see, for example, Lightfoot, 2000, and Friedrich, 1999). Some authors recommended creating a permanent instructional design team and technical support team to overcome this problem (see, for example, Ingebritsen et. al., 1997, and Kuchinke et. al., 2001). These teams would consist of instructional designers/developers, and technical support staff who will act as consultants to the instructors. This consultation may be in the form of offering advice for interactivity and group activities, assisting the instructor with creation of instructional materials, providing technology resources, providing technical assistance and training, and providing troubleshooting. Teams might be located at a resource center. The resource center might also be used for placing the equipment necessary for creating and delivering instructional materials. Ingebritsen et. al. (1997) utilized such a resource center while they delivered their online course. The center they used included equipment such as various Web servers and Web authoring computer terminals, and staff such as technology specialists and undergraduate students. Kuchinke et. al. (2001) received technical assistance from a technical support team consisted of six half-time staff with expertise in Web design and development.

I will categorize design issues under three categories: Web site structure, design principles, and formative evaluation.

Lightfoot (2000) proposes that overall Web site structure should be organized into a Web tree that is wide rather than deep. Making sites that are wide prevents user from getting lost and spending excessive time looking for things. The components Lightfoot (2000) planned to include in his Web site are announcements, syllabus, course handouts, lecture notes, assignments, grades testing, and student support. He puts all these components as second-level pages under course homepage. He further goes to the third-level and defines these categories under student support: bug reports, suggestions, Frequently Asked Questions (FAQ), student discussion, text search, and other useful links. Lightfoot concludes that his implementation didn't match this plan, and it differed. What Friedrich et. al. (1999) added to these components in his WBI site are course objectives, course schedule, technical requirements and "about this site" pages.

Authors seemed to follow a common agreement concerning design principles. Lightfoot (2000) indicated that Web pages in WBI should be visually appealing, consistent, and attractive. Shotsberger (1996) added simplicity to these.

Formative evaluation is seen as an often-used method in many WBI cases to modify the design. Lightfoot (2000) viewed his WBI as a prototype and made additions to and subtractions from his initial design thus continuously evaluating it. Tipton et. al. (1998) conducted formative evaluation with students following each of the design, development, and implementation of their WBI. Changes were made to correct minor deficiencies during the formative evaluation. Friedrich et. al. (1999) indicated that optimal Web design will result from fine-tuning and several iterations of initial design.

Using synchronous and asynchronous tools is very common to provide interaction between the instructor and students and among students. Asynchronous tools used in various WBI cases include such tools as lectures (Shotsberger, 1996), e-mail messages (Lichty, 1997, and Ingebritsen et. al., 1997), and threaded discussion forums (Lichty, 1997, and Kuchinke et. al. 2001)

The most popular synchronous tool used in various WBI cases is the chat function (see, for example, Ingebritsen, 1998, and Kuchinke et. al. 2001).

When assessment is the case, some WBI cases utilized traditional tests and quizzes as a form of assessment (see, for example, Ingebritsen et. al., 1997, and Lightfoot, 2000). However, Friedrich et. al. (1999) indicated that student assessment in a Web-based course should be different from traditional techniques. They evaluated student achievement in their statistics and measurement WBI course with such authentic tasks as written reports and test construction. Kuchinke et. al. (2001) made a similar conclusion and indicated that assessment in WBI should be in performance-based mode and it should include fewer objective tests. Some authors indicated that immediate, frequent, and specific feedback is essential to provide accurate information regarding student performance (Friedrich et. al., 1999, Tipton et. al., 1998, and Kuchinke et. al., 2001).

## **Proposed Design Model**

In this part, a model proposing an orderly process for converting courses into Web-Based format will be explained. Design models can be built in two ways; conceptually, and empirically. The following model is a combination of the information presented in the literature on this topic and the author's previous experience with WBI design. Therefore, it is a model containing conceptual and empirical elements. The model is categorized in 9 phases.

It is recommended that people using the model go phase 1 through phase 9. However, different steps might be taken in each of the phases. In addition, you do not need to implement each of the steps in the phases. For example, if you do not plan to use audio and video components in your course, you may not need to provide a facility for recording, digitizing, and editing audio and video files. Therefore, you may skip step 4.3.

Instructional Systems Technology (IST) department at Indiana University has started a three-year Master's Program to give working professionals an opportunity to get an M.S. degree in instructional systems technology field. As part of this initiative, residential courses in the IST program have been converted into WBI format. R511 'Instructional Technology Foundations I' was such a core course to be converted from residential format to WBI format. The purpose of this course is to provide an introduction to the field and profession of instructional technology. The author of this paper used the guidelines offered in the proposed design model with success with a design team to convert this course into WBI format. Therefore, the model has been used in a higher education setting for converting a course that aimed to teach concepts and knowledge. However, the model can also be utilized in other settings and learning domains.

Phase 1 - Pre WBI Efforts.

1. Infuse the technology into the course prior to WBI. This may be in the form of word processing use, spreadsheet use, e-mail use, Web use, and etc.
  - 1.1. In doing so, go from level 1 (informational) to level 4 (fully on-line). Designers and instructors should develop a site first as a supplement to the in-class course, in which they provide information to students that are relevant to the administration of the class. Then they should go to level 2 (supplementary level) and level 3 (dependent). After completing these stages, they should implement the fully on-line level (level 4). Following these stages will allow the parts to be implemented in chunks. In this way, the transition will be easier and lower levels will provide a base. Besides, instructors and designers will get more experience as the levels increase and they will have knowledge about potential problems and their solutions.
2. Mirror closely the content, structure and requirements of the traditional program. There must be equity between on-site course and WBI course in terms of academic rigor.
3. Model the existing Web-based courses on the Internet. The existing Web-based courses may provide the designers ideas on this issue.
4. For departmental programs (such as a master's degree program), start with core courses and add other courses by time. For this purpose, survey the faculty and ask the following two questions:
  - 4.1. What courses have the potential to convert to a WBI course? Some courses may not be effectively delivered via the web.
  - 4.2. What methods could best be used to deliver the course?

Phase 2 - Create a resource center to support on-line course development efforts.

1. Create a permanent technical support / technical assistance team. The purposes of this team would be:
  - 1.1. To ensure that all the technology is in place and working properly,
  - 1.2. To troubleshoot and provide technical assistance during course delivery,
  - 1.3. To identify problems and suggest solutions,
  - 1.4. To maintain network,
  - 1.5. To upgrade hardware and software,
  - 1.6. To implement web design and development efforts.
2. Create a permanent instructional design team. The design team might include two sub-teams:
  - 2.1. One group might focus on analysis & design.
  - 2.2. The other group might focus on development & production.
3. Provide technology training. The technology used must be transparent to both faculty and students during the implementation of WBI.
  - 3.1. Provide student training.
    - 3.1.1. Provide on-campus workshops.
    - 3.1.2. Provide Web-based workshops.
  - 3.2. Provide faculty training. Faculty should not be distracted by the technology used in the delivery process. Their task should be addressing curriculum issues instead.
    - 3.2.1. Provide on-campus workshops.
    - 3.2.2. Provide Web-based workshops.
4. Provide technology resources.
  - 4.1. Provide software technology. The following types of software technologies might be provided:
    - 4.1.1. Server software
      - 4.1.1.1. Web server
      - 4.1.1.2. Real media server
      - 4.1.1.3. FTP server
      - 4.1.1.4. Other server software
    - 4.1.2. Office applications
      - 4.1.2.1. Word processing software
      - 4.1.2.2. Spreadsheet software
      - 4.1.2.3. Database software
    - 4.1.3. Web design software
    - 4.1.4. Graphics software
  - 4.2. Provide hardware technology. The following types of hardware technologies might be provided:
    - 4.2.1. Servers
    - 4.2.2. Web authoring stations

4.3. Provide facility for recording, digitizing, and editing audio and video files.

Phase 3 - Make an analysis. The analysis could be implemented by surveying the potential or registered students.

1. Identify requirements. Complete disclosure of requirements will help potential students make an informed decision about whether this type of learning environment is appropriate for them.
  - 1.1. Identify requirements for Information Technology (IT).
2. Make a learner analysis. Possible data sources are learner introductions or self-reports done for prior courses, learner preferences expressed in prior course evaluations, and instructors' impressions of the salient characteristics of the course.
  - 2.1. Make an analysis of technology learners possess.
    - 2.1.1. Analyze learners' hardware configuration.
      - 2.1.1.1. Memory size
      - 2.1.1.2. Processor speed
      - 2.1.1.3. Sound card availability
      - 2.1.1.4. Speaker availability
      - 2.1.1.5. CD-ROM drive availability
      - 2.1.1.6. CD-Burner Availability
    - 2.1.2. Analyze learners' software availability.
      - 2.1.2.1. Browsers
      - 2.1.2.2. Browser plug-ins
      - 2.1.2.3. Utilities
      - 2.1.2.4. Office applications
        - 2.1.2.4.1. Word processing software
        - 2.1.2.4.2. Spreadsheet software
        - 2.1.2.4.3. Database software
        - 2.1.2.4.4. Statistics software
    - 2.1.3. Analyze learners' Internet access.
      - 2.1.3.1. Connection speed
  - 2.2. Make an analysis of the venues learners learn.
    - 2.2.1. Home
    - 2.2.2. Workplace
    - 2.2.3. School
  - 2.3. Make an analysis of previous experience learners have with Information Technology (IT).
    - 2.3.1. Word processing experience
    - 2.3.2. E-mail experience
    - 2.3.3. Internet experience
    - 2.3.4. Videoconferencing experience
    - 2.3.5. Level of confidence for using IT
3. Analyze recommendations made by the stakeholders (designers, instructors, administrators, and etc.) of previous WBI courses offered in the institution (i.e., at the department, at the university, and etc.)
4. Analyze the course being converted.
  - 4.1. Analyze previous years' student evaluation data (if available) of the on-site course.
  - 4.2. Obtain a description of the previous content and approach used in the residential version of the course (The easiest way is to obtain the course syllabus).
5. Analyze the existing course management software (i.e., SiteScape, WebCT, BlackBoard, Oncourse, and etc.) and select the most appropriate one aligned with course content, and course activities.
6. Decide on pedagogy (Problem based, group work, and etc.).

Phase 4 - Identify instructional strategies. Provide students ways in which they can practice the knowledge from WBI course in meaningful ways.

1. Make the student an active participant in the learning process.
  - 1.1. Follow a student-centered model instead of teacher-centered model.
  - 1.2. Put the instructor as the mentor/supporter in the WBI model.
  - 1.3. Provide collaborative learning options to overcome isolation in distance learning.
    - 1.3.1. Provide interactivity using different forms
    - 1.3.2. Use multiple sources of information

- 1.3.2.1. Develop partnerships to share resources.
- 1.3.2.2. Provide access to authentic research databases.
- 1.3.2.3. Provide access to educational resources from other colleges or universities.
- 1.4. Utilize multiple lines of communication among participants.
  - 1.4.1. Allow synchronous communication between remote parties. The following Internet tools might be used for this purpose:
    - 1.4.1.1. Chat tools
    - 1.4.1.2. Instant messaging tools
    - 1.4.1.3. Audio conferencing tools
    - 1.4.1.4. Video conferencing tools
  - 1.4.2. Allow asynchronous communication between remote parties. The following Internet tools might be used for this purpose:
    - 1.4.2.1. e-mail
    - 1.4.2.2. Threaded discussion groups
- 1.5. Foster interaction and collaboration among students.
- 1.6. Allow students build informal networks for supporting each other professionally and personally. The following tools might be used for this purpose:
  - 1.6.1. Electronic café
  - 1.6.2. Phone
- 2. Support multiple learning styles.
  - 2.1. Allow students learn by seeing and hearing information.
  - 2.2. Allow students learn by doing active learning assignments.
  - 2.3. Allow students learn by reading material.
- 3. Provide problem-solving activities.

Phase 5 - Provide a well planned administrative structure. This structure should facilitate the communications and exchange between the university, the department and distance student. Although WBI students contact with the institution less frequent than conventional instruction, the interaction is more meaningful.

- 1. Provide secretarial personnel.
- 2. Provide clerical personnel.
- 3. Provide para-professional personnel.

Phase 6 – Design and develop the WBI.

- 1. Design team members should have a shared vision of how this conversion project has to come together.
- 2. Organize the development efforts with the following labels:
  - 2.1. Content Materials (the resources provided by the client)
  - 2.2. Instructional design documentation (the instructional units developed by the development team)
  - 2.3. Interface design documentation (templates, web site mock ups, sketches)
  - 2.4. Multimedia resources (multimedia components of the course and graphics)
  - 2.5. Sample documentation (examples of navigation and ID documentation from previous WBI courses)
  - 2.6. Project management documentation (production plans, roles, interim reports)
- 3. Organize the design and development team around the following roles:
  - 3.1. Project manager
  - 3.2. Technology manager
  - 3.3. Documentation manager
  - 3.4. Content manager
  - 3.5. Regular member
- 4. Meet periodically with the client to make major decisions and to update them on the design progress.
- 5. Prepare a general template and use it for each of the course modules/weeks/structure.
- 6. Balance the residential content of the course by reducing/adding the content.
- 7. Include the following components on the WBI web site:
  - 7.1. A homepage
  - 7.2. A detailed course syllabus
  - 7.3. Expectations from students
  - 7.4. Deadlines
  - 7.5. Grading criteria

- 7.6. Course objectives
- 7.7. Course procedures and policies
- 7.8. Course schedule
- 7.9. Links to course content
- 7.10. Resources
- 8. Supplement course content with multimedia components.
- 9. Be consistent throughout the web site in terms of format (i.e., same PowerPoint format) and phrasing.
- 10. Provide documentation to the course instructor.

Phase 7 - Eliminate technological barriers as much as possible before the beginning of the actual WBI course.

- 1. Support and train the students for online courses. In traditional classroom instruction, students are ready to participate in the course. However, learning in a WBI course requires a set of skills, knowledge and abilities some students are not prepared for. Preparation for both technical aspects and for the distance-learning mode is necessary. In this sense, the following should be implemented:
  - 1.1. Provide students an orientation period (online tutorial and practice sessions) before the actual beginning of the class. These sessions will help students become familiar with the tools and techniques of online learning before the beginning of the WBI course.
  - 1.2. Provide students a basic computer literacy course. The following topics might be covered in this course:
    - 1.2.1. Multimedia software
    - 1.2.2. Web authoring software
    - 1.2.3. Conferencing tools
    - 1.2.4. Sending e-mail
- 2. Support and train the instructors.

Phase 8 – Assess the students.

- 1. Put emphasis on application rather than content acquisition during the assessment. Assess the student achievement with authentic assessment tasks. These authentic assessment tasks might be:
  - 1.1. Deliverable driven
  - 1.2. Discussion driven
  - 1.3. Presentation driven
- 2. Provide formative evaluation techniques.
  - 2.1. Utilize short answer quizzes.
- 3. Provide summative evaluation techniques. In doing so, use fewer objective tests than traditional settings.
  - 3.1. If you utilize traditional assessment techniques, allow learners to use a cheat sheet to curtail academic dishonesty.
- 4. Provide grades with password protection so that students can access only to their own grades.
- 5. Provide timely feedback on all kinds of assignments.

Phase 9- Evaluate the WBI.

- 1. Provide ongoing formative evaluation. Keep the features that are deemed useful, eliminate others or modify them.
  - 1.1. Maintain the web site regularly.
  - 1.2. Eliminate the bugs.
  - 1.3. Proofread and revise the site content. Look for typos, punctuation and capitalization problems, grammatical errors, and content that seems out of plan.
  - 1.4. Satisfy with the short-term results and use the initial feedback to continue with the development of the WBI.
  - 1.5. Survey students regarding their perceptions of the WBI. For this purpose, use a method that allows students to make anonymous comments on the class while the WBI is underway.
  - 1.6. Test the site across different browsers and computer platforms (Windows and Mac).
- 2. Calculate potential savings by converting the courses to WBI mode, and Return on Investment (ROI). Effective WBI courses require the allocation of a variety of resources. These resources make up the overall cost of the WBI course. In return, the institution expects benefits as the result of the investment. If benefits exceed costs, the WBI course can be considered as a viable academic alternative.

## Conclusion



This literature review showed that without a time-proven WBI model, practitioners have been trying to convert existing courses into Web-based format. Since they do not follow a common model, there seems to be an inconsistency in the approach taken. Everybody is trying to do something, but they are losing valuable time and resources. There is an absolute need for a solid model for both WBI and conversion of instruction to Web-based format.

Although practitioners did not follow a common model, their conversion of instruction to Web-based format included some common categories such as how to start the conversion, how student and instructor support should be, design issues, how interaction among people should be, and how assessment should be. Examples for each of these categories were given.

There are more to issues to cover in this study such as collaboration, administration, and other situationalities. However, limited space and time does not permit to cover all of them. Since this is a research in progress such issues will be extended in the future.

## References

- Bichelmeyer, B., Misanchuk, M., & Malopinsky, L. (2000). Adapting a Masters Course to the Web: Principles, Strategies, and Recommendations. Paper presented at AECT Conference, Denver, CO.
- Duchastel, P. (1996). A Web-Based Model for University Instruction. *Journal of Educational Technology Systems* 25(3): 221-28.
- Duffy, J.C. (1992). Planning for Computer-Based Distance Education: A Review of Administrative Issues. ERIC Document: ED387169.
- Edwards, C. (1999). Models for Web-Based Instruction: A discussion of recurring themes. Paper presented at AECT Conference, Houston, TX.
- Ehrmann, S.C. (1990). Reaching Students, Reaching Resources: Using Technologies To Open the College. ERIC Document: ED327171.
- Friedrich, K.R., & Armer, L. (1999). The Instructional and Technological Challenges of a Web Based Course in Educational Statistics and Measurement. ERIC Document: ED432262.
- Heinich, R., Molenda, M., Russell, J., & Smaldino, S. (1999). *Instructional Media and Technologies for Learning* (6<sup>th</sup> ed.). Columbus, OH: Prentice-Hall.
- Hisey, V. (2000). The New Media Instructional Design Symposium 2000 Introduction [On-line]. Available: <http://www.influent.com/nmid2000/>
- Imel, S. (1997). Web-Based Training: Trends and Issues Alerts. ERIC Document: ED414446.
- Ingebritsen, T.S., Brown, G.G., & Pleasants, J.M. (1997). Teaching Biology on the Internet. ERIC Document: ED429536.
- Ingebritsen, T.S., & Flickinger, K. (1998). Development and Assessment of Web Courses That Use Streaming Audio and Video Technologies. ERIC Document: ED422859.
- Johansen, R., Martin, A., Mittman, R., & Saffo, P. (1991). *Leading Business Teams: How Teams Can Use Technology and Group Process Tools to Enhance Performance*. Reading, MA: Addison-Wesley.
- Jones, E.R. (1999). A Comparison of an All Web-Based Class to a Traditional Class. ERIC Document: ED432286.
- Keegan, D.J. (1980). On Defining Distance Education. *Distance Education* 1(1): 13-36.
- Kuchinke, P.K., Aragon, S., Bartlett, K., (2001). Online Instructional Delivery: Lessons From the Instructor's Perspective. *Performance Improvement*. 40(1). 19-27.
- Lichty, P. (1997). Information, Institutions, Society and the New Media. ERIC Document: ED409591.
- Lightfoot, J.M., (2000). Designing and Implementing a "Full-Service" Classpage on the Internet. *Journal of Educational Multimedia and Hypermedia*. 9(1). 19-33.
- McManus, T.F. (2001). Delivering instruction on the World Wide Web [On-line]. Available: <http://www.csuhayward.edu/ics/htmls/Inst.html>
- Molenda, M., Pershing, J.A., et al. (1996). *Designing Instructional Systems*. The ASTD Training and Development Handbook. R. Craig. New York, McGraw-Hill.
- Schutte, J.G. (2001). Virtual Teaching in Higher Education: The New Intellectual Superhighway or Just Another Traffic Jam? [On-line]. Available: <http://www.csun.edu/sociology/virexp.htm>
- Shave, C. (1998). So You Want to Deliver a Course Using the Internet! [On-line]. Paper presented at TCC Conference, Honolulu, HI. Available: <http://leahi.kcc.hawaii.edu/org/tcon98/paper/shave.html>
- Shotsberger, P.G. (1996). Instructional Uses of the World Wide Web: Exemplars and Precautions. *Educational Technology* 36(2): 47-50.

Tipton, M.H., Kovalik, C.L., et al. (1998). Technology Tools for Restructuring Course Delivery. ERIC Document: ED423866.

Williams, M.L., Paprock, K., et al. (1999). Distance Learning: The Essential Guide. Thousand Oaks, Calif.: Sage.

# Web-Based Continuing Education: Models and Methodologies

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## Introduction

In 1998, the Department of Education implemented “principles of effectiveness” requiring that all Safe and Drug-Free Schools and Communities (SDFSCP)-funded programs be research-based. To help schools identify and adopt research-based drug and violence prevention strategies, the 1999 Safe and Drug-Free School appropriation of \$566 million included \$35 million for the first year of a new Middle School Drug Prevention and School Safety Program Coordinator initiative.

This new initiative supports the hiring and training of full-time Middle School Coordinators (MSCs) to oversee implementation of drug prevention and school safety programs for students. Specifically, MSCs are expected to:

- Identify research-based drug and violence prevention strategies.
- Assist schools in adopting the most successful strategies.
- Develop, conduct, and analyze assessments of school crime and drug problems.
- Work with community agencies and organizations to ensure students’ needs are met.
- Encourage parents and students to participate in the identification and implementation of research-based prevention efforts.
- Assist in the development and implementation of evaluation strategies.
- Identify additional funding sources for prevention and school safety programming.
- Provide state education agencies feedback on successful programs and activities.
- Coordinate with student assistance and employee assistance programs.

To help recently hired Middle School Drug Prevention and School Safety Coordinators meet the roles and responsibilities of their new jobs, the U. S. Department of Education, Safe and Drug-Free Schools contracted with Education Development Center (EDC) and its partner Social Science Research (SSRE) to create a national center for training and assistance.

Schools and communities face an urgent challenge to design effective solutions to the complex problems of violence, alcohol, tobacco, and other drug use. To assist schools in the selection and implementation of effective prevention programs that are responsive to their needs, the U. S. Department of Education has undertaken several initiatives designed to enhance schools' understanding of what works and expand the inventory of effective programs. Among these initiatives is the Safe and Drug-Free Schools Middle School Drug Prevention and School Safety Coordinator Program, which supports the recruiting, hiring, and training of one or more full-time staff for three years to guide the implementation of drug prevention and school safety programs for middle school students.

A well-trained, full-time coordinator who is familiar with the research on effective prevention programming and who bases programming on sound planning that involves assessment, measurable goals and objectives, effective research-based strategies, and evaluation, should be able to implement prevention programs that better meet the needs of the students in their schools.

Coordinators, however, face several challenges to implementing effective prevention programs: determining which strategies and programs are effective at reducing substance use and violence among young adolescents, monitoring program activities implemented in the school; community members who do not believe

there are drug problems among their youth; and other school district priorities that-while they may be desirable for other reasons may interfere with prevention efforts.

The goal of the Training Center is to work with middle school coordinators through face-to-face trainings and web-based continuing education to enhance their understanding of research-based programs and equip them with the skills necessary to identify research-based strategies based on an assessment of needs in their district.

The U.S. Department of Education's Safe and Drug-Free Schools and Communities Program (SDFSCP), funded under Title IV of the Improving America's Schools Act of 1994, provides funds for virtually every school district in America to support drug and violence prevention programs.

## **Background**

Three online continuing education events for United States Department of Education Middle School Drug Prevention and School Safety Coordinators were held between April and June 2001. The purpose of these events was to provide a menu of skill-based, interactive learning activities that supplement the core training workshop (see Harding and Formica 2000).

One hundred and eighty-six (186) of the 634 MSCs (29%) who participated in the five-day core training workshops registered for at least one of the three online events. Other events will be offered in the future.

This report summarizes evaluation findings across the three online events. Separate reports presenting evaluation findings from each of the events are also available (see Harding and Formica 2001a, 2001b; Formica and Harding 2001).

## **Goals and Content of the Online Events**

The three continuing education online events were intended to: (1) provide support for the implementation of best practices that enable organizational change, (2) build on the foundation established by the five-day core training, and (3) foster the exchange of information and ideas that can transfer knowledge into practice.

Each of the continuing education online events is designed and sequenced to assist MSCs in addressing a set of critical factors for the successful implementation of effective prevention programs: (1) assessing local needs and assets, (2) designing programs to meet desired results, using measurable goals, (3) selecting and implementing programs that are based on research, and (4) evaluating and refining program efforts.

The first online continuing education event, "Using Existing Data in Your Needs Assessment," was designed to help MSCs locate and use available local, state, and national data to determine drug and violence prevention priorities and select prevention programs for their schools and communities.

The second continuing education event, "Identifying Priorities and Strategies for Your Prevention Initiative," was designed to facilitate the development of a comprehensive prevention plan. This event targeted MSCs who had collected information about local needs and were in the process of collaborating with school and community partners to translate community data into prevention priorities and long-term outcome statements, and to identify research-based strategies that will help achieve those outcomes.

The third continuing education event, "Promoting Prevention Through School-Community Partnerships," was designed to provide MSCs with tools and resources to build school-community partnerships that will support and enhance their overall prevention initiative.

## **Organization and Structure of the Online Events**

Each of the online events consisted of seven components: (1) an introduction, (2) a set of clearly defined skills and strategies to be addressed, (3) a set of methods, materials, and timelines, (4) structured activities, (5) discussion areas, (6) an event summary, and (7) client self-assessment and evaluation surveys. The models used to structure the events included:

- *Library Model*: This includes access to online resources such as journals, reading lists, websites, and other subject-related sites rich in relevant information
- *Textbook Model*: This model includes the use of course and lecture, slide presentations, and other class-related documents in various media formats.

- *Computer-mediated Communication Model (CMC)*: This model features collaborative learning for communication and eliciting feedback through the use of asynchronous and synchronous interaction with a facilitator or moderator.
- *Virtual Classroom Model*: This model includes the three aforementioned models plus additional elements of interactive, computer-based instruction such as simulations, games, and various forms of synchronous interaction.

These models were used in various combinations for each event with the predominate mix being that of the library, textbook, and CMC models.

## Evaluation Methods

Coordinators were asked to complete a post-event online survey. These surveys asked MSCs to provide demographic information, rate the overall online events and the different aspects of the events such as the quality and usefulness of the information provided, answer true/false knowledge items about event content, and answer self-report knowledge gain items. The surveys also included several open-ended items that allowed coordinators to report the most and least helpful features of the overall events and to write any additional comments or suggestions.

For the purposes of this summary report, statistical analyses were run on the data collected from the three different continuing education online events to determine whether or not there were any significant differences in the responses given by the coordinators. Results of these analyses (ANOVAs) support combining responses across all three online events. Additional analyses were conducted to determine whether any differences existed between active participants and auditors, and whether participation in multiple events was more beneficial than participation in a single event.

All instruments used to evaluate the events were submitted to the Office of Management Budget (OMB) prior to the events to receive approval under the 1800-0011 Master Plan for Customer Surveys and Focus Groups.

## Results & Discussion

In general, results concerning participants' satisfaction with the three five-day continuing education online events were very positive. On a web-based post-event survey completed after participation in each of the online events, coordinators were asked to rate their overall satisfaction with the online events on a 5-point scale: Very Dissatisfied, Somewhat Dissatisfied, Neutral, Somewhat Satisfied, and Very Satisfied. Eighty-two percent (82%) indicated that they were either "Very Satisfied" (42%) or "Somewhat Satisfied" (40%) with the online events. Participants were also asked to indicate whether or not they would recommend the online events to other MSCs, how much new information/ideas they received through participation in the events, and the usefulness of the information discussed during the online events. These results were also very positive. Eighty-eight percent indicated that they would either "Strongly Recommend" (46%) or "Recommend" (42%) the online events to other MSCs, 79% indicated that they received either "A Lot of New Information/Ideas" (27%) or "Some New Information/Ideas" (52%), and 87% indicated that the information discussed during the online events was either "Very Useful" (43%) or "Somewhat Useful" (44%).

Participants were also asked to rate their satisfaction with five elements of the online events on a 5-point scale: Very Dissatisfied, Somewhat Dissatisfied, Neutral, Somewhat Satisfied, and Very Satisfied. Eighty-seven percent indicated that they were "Somewhat" or "Very Satisfied" with the quality of the materials, 84% with the organization/layout of the event website, 83% with the download speed of the web pages, 82% with the links provided to other websites, and 70% with the role of the online facilitators.

Additional analyses were conducted comparing active participants versus auditors. The differences between active participants and auditors were both small and statistically not significant for the amount of new information they acquired, the usefulness of the information they received, and the time they spent on the events, the true/false items tailored to each event, overall satisfaction with the events, and willingness to recommend the events to other MSCs. However, although non-significant, auditors did report that they gained more knowledge for all of the dimensions assessed for events two and three.

As mentioned earlier in the report, the online courses were originally designed such that there was a very clear distinction made between active participants and auditors. In reality, the differences between the two groups were very minimal. Given the lack of distinction between the two groups, it is not unexpected to find that they did not systemically differ on the majority of the dimensions assessed. Unfortunately, this limits our ability to assess with any certainty whether or not the additional components received by active participants (e.g., facilitated

discussion areas) had a more positive effect on these MSCs or whether these additional components made no difference. In light of the high level of performance and satisfaction measures across groups, we might assume that *both* groups benefited from these additional components, but further research with more precise distinction between groups is needed.

A second set of analyses compared MSCs who participated in multiple events with those who participated in only one event. In general, participation in multiple events was associated with higher levels of performance and satisfaction with the events. For example, MSCs who participated in multiple events were significantly more likely to indicate that they received more information from the events and more apt to report increases in knowledge gained ( $p < .05$ ).

Although not significant, MSCs who participated in multiple events were also more likely to rate the usefulness of the information, the ease of navigation, the ease of use of the discussion/chat area, overall satisfaction with the event, and willingness to recommend the event to other MSCs more highly than MSCs who participated in a single event.

While the different online events are designed to be mutually exclusive of one another, there is a certain degree of overlap and a logical progression of themes from needs assessment through identifying priorities to building partnerships. The pattern of results for MSCs who participated in multiple events, especially the significant increases in information received and self-reported knowledge gain, is consistent with the cumulative nature of the different events. In addition, the format and timeframe for the events (one week with 50 active participants and an unlimited number of auditors per event) suggest that further studies examining alternative designs for continuing education web-based events for adults is warranted. These findings also suggest that it is important to encourage MSCs to participate in multiple events.

## References

- Bannan, Brenda and Milheim, William D. (1997). Existing Web-Based Instruction Courses and Their Design. *Web-Based Instruction*. Badrul H. Khan, ed. Englewood Cliffs, New Jersey: Educational Technology Publications.
- Beasley, Robert E. and Waugh, Michael L. (1996). The Effects of Content-Structure Focusing on Learner Structural Knowledge, Acquisition, Retention, and Disorientation in a Hypermedia Environment. *Journal of Research on Computing in Education*, 28(3), 271-291.
- Calvi, Licia. (1997). Navigation and Disorientation: A Case Study. *Journal of Educational Multimedia and Hypermedia*, 6(3/4), 305-320.
- Catledge, Lara D. and Pitcow, James E. (1995). Characterizing Browsing Strategies in the World-Wide Web. *Computer Networks and ISDN Systems*, 27(6), 1065-1073.
- Chute, A., Thompson, M., & Hancock, B. (1999). *The McGraw-Hill handbook of distance learning*. New York: McGraw-Hill.
- Cockburn, Andy, and Jones, Steve. (1996). Which Way Now? Analyzing and Easing Inadequacies in WWW Navigation. *International Journal of Human-Computer Studies*, 45(1), 105-129.
- Dieberger, Andreas. (1997). Supporting Social Navigation on the World Wide Web. *International Journal of Human-Computer Studies*, 46(6), 805-825.
- Dryoweb web-based training. (1997). [On-Line]. Available: <http://www.dryoweb.com/wbt/>
- Ellis, Rick. (1997). Effective use of the web for education design in principles and pedagogy. [On-Line]. Available: [~rells/workshops/design](http://rells/workshops/design)"<http://weber.u.washington.edu/~rells/workshops/design>
- Hale, C. (Ed.) (1996). *Wired in style: Principles of English usage in the digital age*. San Francisco: HardWired.
- Formica, S.W. and Harding, W.M. Evaluation Findings for MSC Continuing Education Web Event #3: Promoting Prevention Through School-Community Partnerships. Prepared for Education Development Center, Inc., Newton, MA (USED). 2001.
- Hall, Brandon. (1997). FAQ for web-based training. *Multimedia and Training Newsletter*. [On-Line]. Available: <http://www.brandon-hall.com/faq.html>
- Harasim, L., Hiltz, S. R., Teles, L., & Turoff, M. (1997). *Learning networks: A field guide to teaching and learning online*. Cambridge, MA: MIT Press.
- Harding, W.M. and Formica, S.W. Evaluation Results on the Training Workshops for Middle School Drug Prevention and School Safety Coordinators Summary Report: Overall Process and Outcome Evaluation Results. Prepared for Education Development Center, Inc., Newton, MA (USED). 2000.

Harding, W.M. and Formica, S.W. Evaluation Findings for MSC Continuing Education Web Event #1: Using Existing Data in Your Needs Assessment. Prepared for Education Development Center, Inc., Newton, MA (USED). 2001a.

Harding, W.M. and Formica, S.W. Evaluation Findings for MSC Continuing Education Web Event #2: Identifying Priorities and Strategies for Your Prevention Initiative. Prepared for Education Development Center, Inc., Newton, MA (USED). 2001b.

Harmon, Stephen. (1995). Novice Use of a Dimensional Scale of the Evaluation of the Hypermedia User Interface: Caveat Emptor. *Computers in Human Behavior*, 11(3/4), 429-437.

Harrison, N. (1998). *How to design self-directed and distance learning programs*. New York: McGraw-Hill.

Hiles, Jeanne M. and Ewing, Keith. (1997). Designing and implementing instruction on the world wide web. [On-Line]. Available: <http://lrs.stcloud.msus.edu/ispi/proceeding.html>.

Jones, Marshall G. and Farquhar, John D. (1997). *User Interface Design for Web-Based Instruction*. Web-Based Instruction. Badrul H. Khan, ed. Englewood Cliffs, New Jersey: Educational Technology Publications.

Kahle, David. Learning in cyberspace: Computer mediated communication and distance education. [Online]. Available: <http://www.mit.edu:8001/afs/athena.mit.edu/user/d/j/djkahle/www/4.207/home.html>.

Kahn, Badrul. (1997). Web-based instruction (WBI): What is it and why is it? *Web-Based Instruction*. Educational Technology Publications: Englewood Cliffs, New Jersey.

McManus, Thomas Fox. (1996). Delivering instruction on the world wide web. [On-Line]. Available: <http://ccwf.utexas.edu/~mcmanus/wbi.html>

Ritchie, Donn C. and Hoffman, Bob. (1997). *Incorporating Instructional Design Principles with the World Wide Web*. *Web-Based Instruction*. Badrul H. Khan, ed. Englewood Cliffs, New Jersey: Educational Technology Publications.

# Distance Learning and Student Strategies

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## Abstract

*This paper reports the results of a two-part qualitative study into student strategies for learning in distance learning courses offered at Teachers College, Columbia University. Verbal Protocol Analysis was used to gather information on the cognitive strategies students used to solve problems encountered as they navigated through the site. A semi-structured interview was also conducted with participants to gain insight into student attitudes and perspectives on learning in the online environment. The theoretical framework of Activity Theory was used to develop a deeper understanding of the systemic roots of tensions in the online classroom environment. Conclusions include suggestions for specific teaching practices and design solutions to alleviate these tensions.*

## Introduction

Online education is a relatively new phenomenon, which is increasingly seen by institutions and educators as a viable alternative to the traditional face-to-face class. Past research into online education has focused primarily on media comparison studies. These studies have generally resulted in a 'no significant difference' finding, which Lockee, Burton and Cross (1999) have criticized as useless research, "...failure to reject the null hypothesis means just that and nothing more; just as a legal finding of not guilty does not mean innocent." (Lockee et al. p. 38). Studies that rely on comparing achievement on classroom assessment measures between in-person courses and online courses tell us nothing about the actual effect of the distance learning media on the experience of the individual learner. McIsaac and Gunawardena (1996) recommend that future research focus, in part, on "Examin[ing] the characteristics of the distance learner and investigat[ing] the collaborative effects of media attributes and cognition" (p. 431).

The need for further and more focused research was reiterated by Harasim (1996) who claimed that it was no longer necessary to prove the viability of educational computer networking; rather, further research should study the learning processes in online environments and "the patterns of human interaction in decision-making, problem-solving, and knowledge building."

Therefore, this qualitative study departs not with the goal in mind of trying to prove or disprove the effectiveness of the online medium, but rather from the assumption that the Internet is a viable delivery mechanism, and the design of Internet-based programs needs to take into account the processes and strategies used by the learner in order to increase effectiveness.

## Methodology and Analytic Framework

This pilot study used a grounded theory approach (Glaser and Strauss, 1967) to qualitative research in order to find patterns and strategies for learning that emerge from the learner's perspective, using the process of sorting, coding and comparing the data collected in interviews and observations of students enrolled in online courses through Teachers College Distance Learning Project (DLP). Two online platforms are used in the DLP, Blackboard and Prometheus. These commercial educational web site templates provide a course structure for teachers as well as communications tools to facilitate interaction.

Engstrom's Activity Theory model was used as the framework for analyzing student behavior in the online environment. Theoretical propositions concerning the components of successful online course design emerged from careful analysis of (i) the behaviors and attitudes students demonstrate as they move through their online course; (ii) the level of interaction between the learner and the different aspects of the online course; (iii) the steps and decisions that the learner makes while navigating the course site.

## Procedures

Using a technique known as Verbal Protocol Analysis (VPA), based on Ericsson and Simon's "Thinking Aloud Processes" (1993:78), the participants were instructed to verbalize their thoughts as they navigate through the course web site. This process was captured on videotape by placing the camera behind the participant and focusing



on the computer screen, while a microphone recorded the speech. The purpose of the verbal protocol analysis was to observe what actually happens when students participate in an online course, and to reveal—as they happen—the points at which students make decisions which will potentially affect their learning experience. During a semi-structured interview, the participants were asked to reflect more deeply on their actions as exhibited during the VPA task.

The think-aloud technique requires the participant to verbalize her thoughts as she works through a cognitive task. The procedure is designed to reveal the cognitive processes the participant is undergoing as she performs the task. Social verbalization includes explanation and description of one’s thoughts while performing a task. Social verbalization is distinct from think-aloud through the addition of explanatory and descriptive elements. In order to minimize the amount of social verbalization and maximize the think-aloud activity, the researchers executed the following procedure as outlined by Ericsson and Simon (1993):

First the experimental situation is arranged to make clear that social interaction is not intended, and the experimenter is seated behind the subject and hence is not visible. The “think-aloud” instruction explicitly warns the subjects against explanation and verbal description. Second, after the instruction is presented, the subjects are given practice problems in which it is easy to verbalize concurrently and from which they attain familiarity with the normal content of think-aloud verbalizations (p. xiv).

The participants were instructed to verbalize their own thoughts; they were told not to explain anything to the researchers and that in fact there would be no interaction during the think-aloud unless the participant grew quiet, at which point the researcher would prompt the participant to “keep talking.” The participants were given a math problem and a language problem to solve (Appendix A), as a way to practice the think-aloud technique. The think-aloud procedure is difficult for individuals to execute. According to Ericsson and Simon (1983) “When an investigator instructs a subject to think-aloud, some subjects may misunderstand the instruction and produce instead the more common social communication, explaining or describing the process to the experimenter” (p. xiv). The participants in this study produced both social communications, explaining and describing the web site to the researchers, and true think-aloud verbalizations. However, the information that was received from the participants is rich data, which reveals much about the online educational experience for them.

After the think-aloud section of the experiment, brief interviews were conducted with each participant. The interview sought to uncover further information about the approaches to learning the participant employed in the online course. The interview also posed questions about the social aspects of the experience.

### Sample

A total of four participants took part in this pilot study. The participants voluntarily took part in the study and they represent a convenience sample of students taking online courses at Teachers College in the spring, 2001 semester. The four students were all enrolled in different courses. The results of the study are not generalizable to a larger population and serve mainly to provide insight into the experience of the individual participants. Table 1 contains the ethnographic and questionnaire data obtained from the participants. Participant names are fictitious.

*Table 1*

Participant	Degree Program	A g e	S e x	Ethnicity	How many online courses have you taken (including this one)?
Karen	MA Sociology & Education	30	F	White/Latina	One
Myriam	Ed.M. International Ed.	32	F	Latina	One
Ann	MA Sociology & Education	25	F	White	One
Jean	Not enrolled in Degree Prog.	48	F	White	Two

### Findings

Several important themes emerged from the analysis of the transcripts including: web site design flaws; the use of cognitive strategies and coping strategies; the effects of virtuality; and the effects of learning differences in the online classroom. These themes have important implications for future design on online learning environments, and each theme on its own could be the focus of future research.

### **Web Site Design Flaws**

Each participant expressed some confusion regarding orientation to the organization of the class and the flow of the syllabus. The participants attributed this confusion to the instructor's layout of the course materials in the online environment. Ann experienced the most bewildering design of all four participants. The online course she took used three different web sites, with three separate URLs to convey the subject matter (Professor's self-created web site), conduct the online discussions (Prometheus platform) and hold the synchronous chats (Blackboard platform). During the think-aloud section Ann made mention of the difficulty in navigating through the various sites associated with the course six times. The Professor's self-created web site was particularly frustrating for Ann. Among the many navigational problems with this web site, the Professor used a moving JavaScript window as a menu bar. This box moved down the page as the viewer scrolled down, obscuring parts of the web site that the viewer wished to see. In the interview section Ann expressed the desire for a more transparent design. "I wish they all would have been on the same web site. I wish there would have been like a way to directly link between. It took me a long time just to remember the names [URL's]." This course design was a source of frustration for Ann, which unnecessarily interfered with the learning experience.

Karen also experienced confusion and frustration with the layout of the course. The course Karen took was presented using the Blackboard platform. Karen stated during the think-aloud, "but this is where its really confusing because, I'm here and this is called equity, this week's called equity, but if you go back to course documents where it gives us the readings to prepare for class you don't see anything listed as equity." As Karen made this comment she was jumping back and forth between the *Communications* section of the site and the *Course Documents* section of the site in an attempt to figure out which discussion topic corresponded with the current week's readings. The lack of consistent labeling between the course documents section topic listings and the corresponding discussion forum in the communications section was a design flaw that caused problems for Karen. To cope with the disorientation she described, Karen developed the strategy of referring to the contents of the student discussion for clues as to what the current topic of study was.

### **Use of Cognitive and Coping Strategies**

Karen used this strategy—referring to the work of other students—to solve problems she encountered in the online environment, for both organizational and educational purposes. Karen scaffolded her own comprehension of assigned texts by first reading the comments of others in the discussion board which referred to these assigned readings. "I would usually go and read what other people have written and then go actually do my reading for the week" and "I usually read them [other people's comments on the discussion board] so I kinda have an idea of what people are talking about before I do my reading." This strategy provided Karen with a meaningful overview of the material to be read. The focus of the conversation in the discussion forum alerted Karen to the nature of the content of the material to be read and to what her fellow students found most noteworthy as a topic of discussion within the readings. This strategy is akin to the notion of advance organizers postulated by Ausubel et al. (1978). As Driscoll (1994) summarizes, "Advance organizers are relevant and inclusive introductory materials, provided in advance of the learning materials" (p. 126).

Each of the participants in this pilot study mentioned their own referral to other student's work as a method of learning in the online environment. Ann and Karen were both enrolled in theoretical courses. Ann reported during the think-aloud "If I don't understand the question from over here, sometimes I go in and find out what other people have written about it." Ann's strategy is similar to Karen's; that is, the thoughts of classmates are used to scaffold reading assignments and gain clarification on the topic question at hand.

Myriam and Jean were both taking design courses. They would look at other student's design ideas to help spark their own creative imaginations. Myriam remarked:

I'm learning from my classmates in terms of...when I know there is an assignment going on or something, in the process of doing it, I check what they [the other students] have been doing so I learn from that 'oh wow that's a good idea.'

Likewise, Jean mentions, “I want to look at other students work. This is work I’ve not done yet. I may just get an idea.”

It is possible that Karen and Ann could apply their strategies in a face-to-face class; they could listen to the class discussion of the readings for the week and then do the readings subsequent to the class. However, the online environment provides a concrete and consistent source of student input. Moreover, it is highly unlikely that Myriam and Jean could have access to fellow student’s designs in a face-to-face class. This is a unique affordance of the online course for Myriam and Jean.

Another strategy that was deployed by all of the participants was the coping strategy of printing out course materials (such as lecture notes and electronic texts) to read off-line. The commonly used cognitive strategies of highlighting, underlining or otherwise denoting important sections of a text are not readily available in a computer-based environment. Both Jean and Ann expressed the desire for a highlighting tool that would allow them to take notes in an electronic text the way they normally would with pen and paper. According to Ann “It’s kind of strange reading text on the screen as opposed to reading books. It’s harder to go back and there’s not the ability to highlight and underline and figure stuff out, which is what I’m used to doing.”

These actions showed that students are coming up with strategies to cope with the unfamiliar attributes of this new learning environment, and even discovering new ways to learn their course materials as a result. Thus it is useful to differentiate between ‘learning strategies’ (advanced organizing), and ‘coping strategies’ (printing course readings) as two observable types of behavior. The former can be described as a deliberate action that contributes to learning the course content, but which may be the same as a strategy used in face-to-face courses. The latter, a coping strategy, is an action exhibited by the participants that is used to compensate for an unfamiliar and unique attribute of the online experience. In many cases an action could be both a coping and a learning strategy, or more importantly, the coping strategy often becomes that which contributes to learning the course content. We will see other examples of learning and coping strategies throughout our findings.

### **Effects of Virtuality**

The fact that one is not able to utilize well-known cognitive strategies in the online environment is a negative effect of virtuality. The virtual nature of the online course gives it certain characteristics not found in a face-to-face class. Freed from temporal and spatial boundaries, the online course may be accessed at anytime, from any location. Social interaction in the virtual environment is largely relegated to textual exchanges on the discussion board, in the chat room or through email. Body language, eye contact and physical appearance are communicative modes not available in the online course. These aspects of virtuality have an effect upon the student experience. The participants reported both positive and negative effects of virtuality. The synchronous chat was Ann’s favorite aspect of the online learning experience. Ann emphasized the way the chat format allowed her to have more participation in the class due to the suspension of the “social rules” at work in the face-to-face classroom.

[T]here’s something about getting up and speaking forth your idea – which you’re not even sure [of] because you are still formulating – in front of people that is scary, that is intimidating, especially if you don’t feel like you know the people in the class, have a good rapport with everyone. Whereas the first evening of the chat it took a little bit for me to jump in there and put forth my ideas, but it was fine after that, and once I felt like I had a place in the conversation, it was a lot easier to talk.

Ann found the “organic, nonlinear” nature of discussion in the synchronous chat room to be a compelling learning activity:

It’s amazing what a different kind of activity the learning process is, because you are constantly having all these conversations with people um and that – you have to jump in, you have to participate – you can’t just sit back. People respond to a thread and then another thread develops from it and then its more organic, it’s a lot less linear.

Moreover, the dilemma posed by ‘having to jump in’ to a synchronous chat turned into an opportunity for Ann to learn the content better, because she began preparing for her chat by reading and reviewing her course materials in detail before the chat session. This is an example of a coping strategy that becomes a learning strategy as well.

Interestingly, it is the lack of proximity that allowed Ann to feel more confident in the class. She felt like she got to know the students in the online class in a way that she seldom did in a face-to-face class: “You have a

sense of people who have similar ideas, you have a sense of people, what people's interests are, I feel probably that I know people in the class better than I would know people in a regular class."

However, lack of proximity was also the major negative effect of virtuality cited by the participants. The feeling of isolation and the lack of getting to know the Professor and the other students in the class was a common issue. Myriam remarked: "I feel that I'm like maybe too much by myself. I don't like that part. I don't feel like I have that much feedback and I'm sometimes I feel like I am lost."

Jean also mentioned that she did not like interacting by e-mail and that she missed the "spontaneous" nature of face-to-face communication. "Personality wise I like to see faces, you know. I move my hands when I talk. It's easier. You are more spontaneous when you interact directly. I think it is difficult to interact by e-mail." Even Ann noted that she made a point to go by the Professor's physical office in order to meet him. "I actually went by and introduced myself to him because I thought it was kind of strange to be taking the course without ever having set eyes on him."

Karen expressed the most difficulty with the effects of virtuality. The collapse of time and space boundaries manifested in the anytime, anywhere nature of the online class was a very troubling aspect for her. She consistently lamented the lack of face-to-face elements in the online class. Her dissatisfaction with the online experience seemed to be inversely proportional to her expectation that this modality would be similar to a traditional face-to-face class. In both the think-aloud section of the session and the interview section, Karen implicitly and explicitly expressed confusion, frustration and difficulty with both the collapse of time and space boundaries and the virtual aspect of the online environment.

Like the week starts on Sunday, so these classes are actually seven days a week, whereas I'm used to thinking of school between like Monday and Friday. It's like this, people post on the week-ends so it's just even more work it's just : it's like its ongoing it's never complete.

Karen further explicated this sense of feeling overwhelmed in the following passage:

[P]eople add new ones [comments to the discussion forum] after that week is over, which is confusing for me. Because like : 'classroom community' was, you know, three weeks ago and: there's 47 new [comments on the discussion topic], and that week I read them all, but like what are people still talking about?

Karen's frustration with the ongoing nature of the discussion in the online classroom revolves around the extra amount of work entailed in keeping up with several discussions.

It's like by the time we get down to the end of this class we're gonna have to read everything it's gonna take like hours to go through and read everyone's responses and how responsible are we supposed to be for all of this? In a normal class you just go each week and the topic would be equity and you only have to be responsible for that.

The fact that students can access the conversation at any time during the week and the fact that they could still contribute to the conversation after the class had moved on to the next topic is a crucial difference in the online and face-to-face experiences. The opportunity to read and re-read comments in the student discussion board creates a whole new learning opportunity for students in the virtual classroom, but they must first learn to abandon their previous temporal and spatial notions of classroom learning.

In the interview section of the session, when asked how she approached learning in the online course, Karen responded "Well, I try to fit it into the schema that I think of as a normal class. And it doesn't really seem to fit." The fact that Karen came to the online class with the traditional face-to-face class schema is a deducible one. Few students at this point in time have much experience with online education, so the primary conception of class is the traditional face-to-face mode.

In line with this schema, Karen expresses her preference for the proximal pleasures of the face-to-face experience. "I like going to class, I like listening to discussions, I like being in the room having that moment in time with a group of people discussing ideas." She also expresses her frustrations with the virtual nature of the online class. "I feel like I'm faking the class, I don't feel like I'm really taking it. I mean I'm doing the readings, but its such an isolated experience." The lack of proximity appears to result in less meaningful learning for Karen:

Whereas when, online I might be reading twelve comments in a row and so your click, click, click commenting. I forget what the other people said and it kind of starts to blend together. Whereas, when your in class you see the person who said it and that's what you want to remember, even though three more comments come in between you might go back and say I remember what Susan said blah blah blah blah. Because she's right there, its in the moment, its an interaction.

It is possible that Karen uses visual cues to encode new information. In a discussion of human memory and retrieval Anderson (1995) explicates various contextual cues individuals use to encode information. Karen seems to use the visual cue of other speakers' physical appearance to help her encode information in a class. The comment above implies that by remembering who spoke, Karen also remembers what it is the person said. Therefore, the lack of such visual cues in the online environment could prove to be a true impediment to cognitive functioning for Karen.

Jean also cited the lack of visual presence and identification of her classmates as an issue, but one that she was able to cope with by making connections between students' personal profiles and their course participation. For her it wasn't enough to read only the names of those participating in the discussions, or what they had to say. She needed to find out who they were, what they did for a living, and construct a personality with the available clues. These included not only the personal information students posted about themselves online, but also their style of writing and project participation. While looking at her classmate's projects, Jean remarked "You can really see the personality of the student, the way I imagine him" and "He likes to be funny, this Mark."

This value placed on getting to know the other students was also a coping strategy used to compensate for the lack of face-to-face interaction as found in the on-campus course. Jean knows that there are other people who are experiencing the course and working on the assignments just like she is. By recalling personal facts about each classmate as she reads their work, Jean is able to synthesize otherwise disjointed bits of information into a coherent set of content, thus her coping strategy also contributes to the learning process.

## **Learning Differences**

Karen is a student in a degree program at Teachers College, and she comes to campus regularly for courses. It happened that this course wasn't offered on campus this semester, so she had to take it online. The fact that she did not choose the online environment no doubt contributed to her significantly negative attitude towards the experience, but she also described herself as a social learner, and a vocal person overall, who learns best in groups. Karen made frequent comments about her preferred way of learning and defined herself as a "traditional learner." One of the most important learning outcomes Karen felt she experienced from her online class was the appreciation and empathy she developed for students in her first grade class who have differing learning styles. "It helped me to be a better teacher in that I'm more understanding of my students who have learning differences."

Karen's point about learning differences is crucial for understanding student behavior and performance in the online learning environment. Her assessment of herself as a traditional learner may have inhibited her from taking full advantage of the affordances of the online medium. Throughout the think-aloud, Karen made comments such as the following. "I feel like there is probably an easier way to be doing this class than I'm doing it, but like I'm always doing it this way, where I'm not quite sure what we're supposed to be reading or doing." However, she also found ways to utilize the affordances to her advantage, such as the aforementioned strategy of reading student comments on a topic as if they were an advance organizer. She also noted that the ongoing nature of the student discourses would be useful if "you want to write a paper on that topic or something."

Had Karen been able to adapt her learning style to the online environment, she might have had a very unique learning experience, much like the one Ann quite unexpectedly had herself. Ann is also a student in a degree program on campus, but she works full time and takes only one other class. The on campus section of the course that she is taking online was offered on a different day than the other course she took on campus, and so rather than coming to campus two days per week, she decided to enroll in the online section of the course. Therefore, unlike Karen, the choice to take an on line course was a convenience, and so she may have entered the experience with a more positive attitude. Whereas Karen relied on the structure of the in class course, Ann found that structure too limiting, too linear. "I feel when you are in a class there are a lot of rules that people follow," for example, one person talks at a time, students don't interrupt each other, they follow the train of thought that the last person said. Furthermore, Ann described herself as shy in class, and she felt less inhibited online, whereas Karen described herself as a very vocal person, who felt she couldn't be heard online.

Ann adapted to the online experience in many ways. For example, technologically, she found innovative ways to work with multiple browser windows, which was a coping strategy used in the online chats so that she could

refer to her notes and the Professor's Website at the same time. Ann was particularly pleased with the online chat feature of her course, which proved to be the activity that transformed her learning experience and her beliefs about learning. Ann reported that the online learning class "broke me out of what I would normally say learning was in the regular classroom...I'm kind of doing a lot of it independently."

Another example of the independent nature of online learning is the asynchronous discussion board feature of her class. Ann noted that it was challenging to be on her own and required to write short-answer responses to thought-provoking questions: "I hadn't had anyone to talk to about those issues...it was me doing it on my own ...trying to come up with links between pieces." Making connections is something that was normally done in class, by the Professor, or by other students asking questions. Ann was willing to take risks in the course and with her own participation, which may have made all the difference in transforming the negative feeling of isolation into a positive feeling of independence.

The online class experience created many potentially frustrating tensions for the participants. The tensions arose not just from a lack of inexperience with the online medium, but also from the whole of the system itself. This assertion is evidenced in the data -- poorly laid out course materials, collapse of time and space boundaries, the virtual nature of interaction, isolation -- all of these elements contributed to the tensions the participants experienced.

### **Activity Theory**

Activity theory provides a lens through which we may view the whole of the system and begin to understand, through analysis, the causes of the tensions reported in the findings. This analysis also makes possible the derivation of ideas for adjustments to the system that will result in the easing of these particular tensions. Activity theory has great potential for the refinement and efficacy of practice in any system -- educational, organizational or social.

Activity theory developed from the work of Soviet psychologists Vygotsky and Leont'ev, who were both greatly influenced by the philosophical writings of Marx and Engels (Engestrom, 1999). Activity theory constitutes an analytical framework that stresses the importance of a cultural-historical and dialectical approach to the understanding of human activity and societal or systemic change. Vygotsky (1978) articulated the need for a new approach to understanding human activity thusly:

All stimulus-response methods share the inadequacy that Engels ascribes to naturalistic approaches to history. Both see the relation between human behavior and nature as unidirectionally reactive. My collaborators and I, however, believe that human behavior comes to have that 'transforming reaction on nature' which Engels attributed to tools. We must, then, seek methods adequate to our conception. In conjunction with new methods, we also need a new analytic framework (p.61).

These ideas were expanded upon by Leont'ev (1978) "...activity is not a reaction and not a totality of reactions but a system that has structure, its own internal transitions and transformations, its own development...In all of its distinctness, the activity of the human individual represents a system included in the system of relationships of society." (pp.50-51). The definition of human activity as a multi-directional, societally embedded, transformative system stands in direct contrast to the western notion of the autonomous individual, which is perhaps the reason why activity theory has only recently gained attention in the west. However, in the last two decades western educational researchers have begun to utilize activity theory as an analytical framework for understanding participant activity in educational and organizational settings.

Engestrom has led the way in adopting an activity theoretical approach to the analysis of such settings, and has contributed to the further development of the theory by creating a model of an activity system that can be readily applied by researchers. According to Engestrom and Miettinen (1999) "Minimum elements of this system include the object, subject, mediating artifacts (signs and tools), rules, community, and division of labor" (p.9). The last element of Engestrom's model is the outcome of the activity system. Barab (2001) notes "Activity theorists are not simply concerned with doing as disembodied action but are referring to doing to transform some object, with a focus on the contextualized activity of the system as a whole" (p. 2). In this clarification, the outcome is the transformed object. Barab (2001) continues:

By subjects, activity theorists are referring to the individuals or groups whose agency is selected as the point of view for the analysis. Objects can be conceptual understandings, raw materials, or even problem

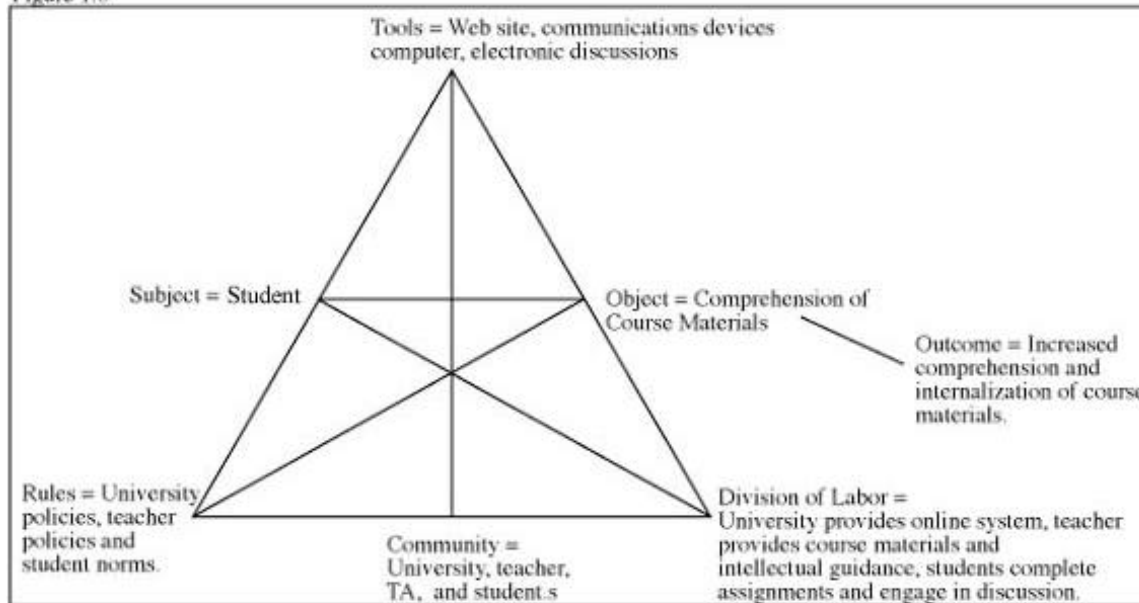
spaces 'at which the activity is directed and which is molded or transformed into outcomes with the help of physical and symbolic, external and internal tools.' (Engestrom, 1993, p. 67)" (p. 2).

The historicity of the activity system is an important concept in the analytical structure of activity theory. As Vygotsky (1978) notes "The psychological development of humans is part of the general historical development of our species and must be so understood." (p. 60). Engestrom (1999) defines the notion of historicity in the context of activity theory as "identifying the past cycles of the activity system." (p. 35).

Three principles govern the interpretation and analysis of data when a researcher takes an activity theoretical perspective: 1) the activity system as a whole is the unit of analysis; 2) the history of the activity system must be taken into account; and 3) contradictions within the activity system can be analyzed "as the source of disruption, innovation, change, and development of that system, including its individual participants" (Engestrom, 1993 p.65). The analysis of the participant's experience in the online class is based on these three principles.

The first task is defining the elements of this particular activity system. For the purposes of this paper, the student participant is the subject of the activity system. In a different analysis, the teacher could be taken as the subject, or the class as a whole could be taken as the subject. This shift in emphasis would necessarily produce different results; how significant this difference would be is unclear. With the teacher as the subject, both the object and the outcome would change; however, the rest of the elements of the system would remain the same. Therefore, this analysis, while significant to understanding the student's experience, does not attempt to tell the complete story of the class. Figure 1.0 details the activity system of the online class that Karen, Ann, Myriam and Jean participated in based on the student as the subject.

Figure 1.0



Online education at Teachers College has existed for three years. The courses in which the students participated had very little history as online courses. In fact, both Karen and Ann were participating in courses that were given as an online course for the first time (Spring, 2001). Therefore, there is no direct online history for these particular activity systems; rather, the history is significantly linked to the traditional face-to-face classroom. The activity system for online education is quite similar to a traditional classroom activity system. The subject, object, community and outcome are the same for both. It is important to note that the historical experience of both the subject and the community in the online classroom is the face-to-face classroom. The expectations and actions of the members of the online classroom activity system have been conditioned by their experience in the traditional face-to-face classroom.

The offering of these courses online constitutes an expansion of the definition of the classroom activity system at the institutional level. A graduate level course at Teachers College is no longer necessarily geographically and temporally located. This expansion represents a historical shift at the institutional level with great consequences at the personal level. Engestrom (1999) discusses the significance of expansive cycles in the life of activity systems.

“‘It is quite natural to endeavor to represent reproduction as *cycles* resulting in the formation of a new social structure on the basis of some preceding one’ (Schedrovitskii, 1988, p.7; italics in the original). Such an irreversible time structure may be called an *expansive cycle* (Engestrom, 1987)...For the historical understanding of activity systems, expansive cycles are of crucial importance” (p. 33).

The new social structure emerging from the expansive cycle that has produced the online course is occurring at all levels of society, not just higher education. Castells (1994) defines this new social structure, “The control over knowledge and information decides who holds power in society. Technocrats are the new dominant class” (p. 41). Students capable of technically understanding the new classroom environment have an advantage over those who do not.

The expansion of the classroom activity system from face-to-face to virtual, coupled with the participant’s historically based expectations combine to create the contradictions and tensions felt in the online class experience. Karen reported in the interview section that prior to coming to Teachers College she had very little experience with computers. “Before I came to Teachers College, I didn’t even have e-mail and I didn’t know what a web address was.” Her expectation of the online class was that it would be similar to a “normal class.” Karen’s description of her learning experiences in the traditional face-to-face class was deeply grounded in the physical, geographic and temporal nature of that experience. The lack of these same features in the new system caused a great deal of distress for her and possibly impeded her intellectual growth. However, it is important to note that Karen found solutions to some of her problems through referring to the semiotic and concrete tool of the archived student discussions. This archive is a new feature of the activity system and it is a potentially rich source of learning within the new environment. The archive of the student discussion represents a new educational artifact that can be continually accessed and continually created. The externalization and dissemination of student thought is a significant innovation and an unparalleled educational tool integral to the new activity system which all of the participants took advantage of.

The design flaws that frustrated participants in the new activity system derive from the inexperience of the teachers in the new environment. In two of the courses, the teachers had never previously taught an online class and were not trained in the instructional design of educational technology. Therefore, errors in web-site architecture were made, including dating and labeling of material and the use of multiple URLs, which caused confusion for participants. The division of labor in the new activity system calls for technological knowledge and ability for all participants. Previously, content knowledge, administrative knowledge and a small amount of technological knowledge (word processor and copy machine functioning) were sufficient for efficacious teaching. In the new activity system we must add to this list the specific technological skills related to internet based communication (utilizing ftp, use of e-mail, web site architecture, understanding of hyper-linking, use of communications devices such as the discussion board and the chat room to name the most basic competencies); and teachers must give additional thought to design and layout of course materials and the facilitation of student participation.

The facilitation of student participation is related both to the division of labor and to rules in the new activity system. The rules for student participation revolved around posting to the discussion board. “I write something just so that I’m getting participation credit,” lamented Karen. The new division of labor for the student includes not only the reading assignments and the essay assignments, but also weekly written participation in the discussion board. Karen continues, “sometimes in class [face-to-face] you don’t always respond [to the discussion]...But I feel like in order to even know, for someone to know I was there, I need to [post to the discussion board].” This tension regarding the new rule of participation is a frustration for Karen, yet it is also a source of learning for her. Again we can note her use of the student discussion to scaffold learning and as a potential resource if one is writing a paper directly related to the topic of discussion.

Communicating with students requires attentiveness not only to the discourse on the discussion board, but also to individual e-mails sent to the Professor. Myriam’s major disappointment in the online class was the lack of interaction with the teacher and the TA; “I send an e-mail and I don’t know if they will answer or not, if they will reply or not and I regret that part.” The new activity system requires a different type of time commitment from the teacher. Rather than holding office hours and a class each week, the teacher in the online environment must be ready to handle student questions and concerns at almost anytime. This is a daunting obstacle for the effective implementation of online education.

The degree of student agency afforded by the environment represents another shift in the division of labor and rule setting. In the new activity system, the community creates rules and norms through their actions. Therefore, the action of any individual within the community has authoritative potential. Those community members possessing the most facility and ease with the technological environment are potential rule makers and trendsetters in this environment. For instance, in Karen’s class she noted that students seemed to post new



comments to the discussion board on Sunday. So, she made a point of going to the discussion board on Monday to read the new posts. Additionally, Ann noted that in the chat room, any one of the participants could initiate a topic of discussion; it is not dependent on the Professor or the TA. While this level of agency may be good for the community as a whole, there is an inherent danger of alienation for the less technically proficient community members.

This danger of alienation has serious implications for the outcome of the new activity system, which in this case is the comprehension and internalization of course materials. This danger inheres for students not only from the potential of the empowerment/alienation dynamic brought about by the new configuration of rule making and division of labor, but also in the poor layout of the course materials, and the virtual nature of the tools. Karen expresses her alienation and her perception of its effect on the activity system outcome "...it feels really artificial and it feels like I'm...more concerned, like I said about, just what I write and being grammatically correct than like truly learning and getting new ideas and becoming a better teacher which was my whole goal of coming here." This negative assessment of the achievement of the intended outcome by Karen was counterbalanced in the interview by her admission that the experience had produced a meaningful unintended outcome for her as a teacher. She states that the experience has made her a more "empathetic teacher." Through her own reflection on the difficulties she had, she realized that different learning styles contribute to student success and satisfaction in a given classroom experience; she is bringing this new understanding back to her first grade classroom.

## **Discussion**

The activity theoretical perspective has revealed both strengths and weaknesses of the new activity system. Many of the tensions Karen mentions can be relieved through specific adjustments to elements of the system. For instance, the inexperience of the Professors in teaching online that led to the design flaws could be addressed by the University through a training and orientation program for them. Likewise, orientation sessions for the students could attenuate the prevalence of historically based classroom expectations and facilitate the acquisition of technical knowledge that would situate each student as a potential leader in the class.

The lack of visual cues to aid in the encoding of information could be addressed by the use of web cams, video teleconferencing may also address this specific issue. The negative effects of the virtual nature of the course (the sense of isolation), could be addressed through the use of synchronous chats and collaborative assignments designed to facilitate student interaction. These adjustments could substantially reduce the frustrations that may impede learning in the online classroom.

Activity theory as a framework for understanding student behavior and experience in the online classroom is extremely useful. The complexity of Engeström's model allows for a thorough view of factors influencing the subject. The emphasis on historical perspective situates the analysis meaningfully in a broader societal context. Indeed, participant reports of their online experience makes most sense in light of their historically based expectation of the traditional face-to-face classroom. The participants are not alone in the holding of this expectation. Society at large is undergoing an expansive cycle of revolutionary proportions regarding technological advances. We do not yet understand the full implications of these developments. Our expectations and prognostications are based on what has gone before. It is only through careful investigation of these emerging processes that we will be able to understand and direct their significance and impact. Activity theory is a useful framework for such an effort.

## **Implications of key findings**

This study was designed to provide qualitative information about the experience of the student in the online course. The four main themes that emerged from the transcripts, web site design flaws, cognitive and coping strategies, the effects of virtuality and learning differences reveal important aspects of this experience. As designers and instructors, we need to pay attention to these aspects and use them as a roadmap to improving the educational experience of the online student. This can only be done if students are given clear expectations about the course format and course contents at the outset. For example, Karen's experience of 'having' to go back and re-read messages from previous weeks' themes could have been turned into a learning strategy by emphasizing that the online environment is not supposed to follow the same schedule as the campus course. That the lessons are never really "done" or "complete" in an online environment is a new concept, but it should be one that is exciting and valuable to the learner. Students should also be aware that they are in important part of the learning process; just as they might eventually depend on other students for guidance or feedback, so those students depend on them for the same reasons. Adjusting student expectations is the work of the instructor. Designers' efforts should focus on

alleviating the negative effects of virtuality and in creating templates that directly support the instructor in developing clear layouts for the presentation and pacing of course materials.

### Methodological considerations

Although we have many enlightening examples of how students behave in an online environment, due to the diversity of courses and web platforms used, it is possible that we were comparing apples with oranges. Therefore, the direct causal relationships—if there indeed were any—between inputs such as student disposition and course platform, and outputs in the form of student satisfaction and motivation to participate were unclear. Further research in this area might explore some of these causal relationships by selecting a more homogenous sample, such as students who participate in the same course, or students who are not currently taking on-campus courses.

Even if we were to repeat this study with a similar group of students, we would try to get more personal information from the students, such as their reasons for taking an online course, their reasons for coming to Teachers College, their aspirations and plans. Having additional information about their values and beliefs on and off campus would have provided us with more factors for analysis of their attitudes and behaviors online. Although most of the participants did compare some aspects of their behavior online to their behavior in class, it would have been interesting to compare their disposition in the online course with their typical disposition in class. Additionally, we might have asked these students what their expectations were before taking the online course and if these expectations changed at all.

This research project raised issues of importance in doing qualitative research based on non-traditional learning environments. For example, how does one observe someone's participation in a course, which typically takes place in isolation? Using the technique of videotaping and verbal protocol analysis may have been an adequate solution, but there is perhaps a better way that has yet to be discovered. Additionally, including in this way students who are located remotely would have been costly and impractical.

A final issue, that is not new to online learning, is how to actually measure learning outcomes. Karen, Ann, Jean, and Myriam all had unique learning experiences, and definitively more or less satisfying experiences, but did any one student actually learn more or less than the others? Did they perform more or less adequately? We can only hypothesize based on research experience with classroom learning techniques, but a more experimental, qualitative approach would have to be undertaken in order to say with certainty that different strategies or course design in the online environment really contributed to improved learning outcomes.

### References

- Anderson, J.R. (1995). *Cognitive Psychology and its Implications* (4th ed.). New York, NY: W.H. Freeman & Company.
- Ausubel, D. P., Novak, J.D. & Hanesian, H. (1978). *Educational psychology: A cognitive view* (2<sup>nd</sup> ed.). New York: Holt, Rinehart and Wilson.
- Barab, S. & Schatz, S. (2001). *Using Activity Theory to Conceptualize Online Community and Using Online Community to Conceptualize Activity Theory*. Paper given at the AERA 2001 Conference. <http://inkido.indiana.edu/aera2001>. April 18, 2001 10:00pm.
- Castells, M., et. al. (1994). *Critical Education in the New Information Age*. New York, NY: Rowman & Littlefield Publishers, Inc.
- Driscoll, M. P. (1994). *Psychology of Learning for Instruction*. Boston, MA: Allyn and Bacon.
- Engestrom, Y. (1987). *Learning by expanding: An activity-theoretical approach to developmental research*. Helsinki: Orienta-Konsultit.
- Engestrom, Y. (1993). *Developmental studies of work as a testbench of activity theory: The case of primary care medical practice*. In S. Chaiklin & J. Lave (Eds.), *Understanding practice: Perspectives on activity and context* (pp. 64-103). New York, NY: Cambridge University Press.
- Engestrom, Y. (1999). *Activity theory and individual and social transformation*. In Y. Engestrom, R. Miettinen, & R-L Punamaki (Eds.), *Perspectives on Activity Theory* (pp. 19-38). New York, NY: Cambridge University Press.
- Engestrom, Y. & Miettinen, R. (1999). *Activity theory: A well-kept secret*. In Y. Engestrom, R. Miettinen, & R-L Punamaki (Eds.), *Perspectives on Activity Theory* (pp. 19-38). New York, NY: Cambridge University Press.
- Ericsson, K. A., & Simon, H.A. (1983). *Protocol Analysis: Verbal Reports As Data*. Cambridge, MA: The MIT Press.

- Fiske, D.W. (1971). Measuring the concepts of personality. Chicago, IL: Aldine.
- Harasim, L., *Computer Networking for Education*. In Plomp, T. and Ely, D. (eds.) International Encyclopedia of Educational Technology. Second Edition. (1996) Great Britain: Pergamon, p. 484-489.
- Glaser, B. and Strauss, A. (1967) The discovery of grounded theory: strategies for qualitative research. Chicago: Aldine Pub. Co.
- Leont'ev, A.N. (1978). Activity, Consciousness, and Personality. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Lockee, B.B., Burton, J.K. & Cross, L.H. (1999). No Comparison: Distance Education Finds a New Use for 'No Significant Difference.' *Educational Technology Research and Development*, Vol. 47, no. 3, 33-42.
- McIsaac, M.S., & Gunawardena, C.N. (1996). *Distance Education* in D.H. Jonassen (Ed.), Handbook of research for educational communications and technology (pp. 403-437). New York: Simon & Schuster MacMillan
- Schedrovitskii, G.P. (1988). Basic principles of analyzing instruction and development from the perspective of the theory of activity. *Soviet Psychology*, XXVI(4), (pp. 5-41).
- Sudman, S., & Bradburn, N.M. (1974). Response effects in surveys. Chicago, IL: Aldine.
- Vygotsky, L.S. (1978). Mind in Society: The Development of Higher Psychological Processes. Cambridge, MA: Harvard University Press.
- Weiss, C. H. (1975). Interviewing in evaluation research. In E. L. Struening & M. Guttentag (Eds.), *Handbook of evaluation research* (Vol. 1, pp. 355-395). Beverly Hills, CA: Sage.

# Falling Behind: A Technology Crisis Facing Minority Students

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## Abstract

*The digital divide is a commonly used term in today's society, but few truly understand the impact that it has on minority students. This issue is one that goes beyond access to technology, but encompasses issues of equity in use. This article will examine the data on home and school computer use by minority students. It will also discuss the College Reach-Out Program (CROP) and the Community Technology Center at Jacob Riis Neighborhood Settlement House, which are two programs giving minority at-risk students non-traditional experiences with technology.*

## Introduction

In 1999, the Department of Commerce published a report entitled, *Falling through the Net: Defining the Digital Divide*, in which they found, "providing public access to the Internet gives certain groups the opportunity to advance by providing them with technical skills which are needed to compete in the digital economy." Those who have access to technology are being afforded more opportunities than ever before, but one must also think about what happens to those being left behind. There is a global discussion occurring surrounding the issue of the "haves and have-nots." Most research on the subject has uncovered what has come to be known as the "digital divide" or the separation between those who have access to and can effectively use technology and those who do and cannot.

This article will discuss how the digital divide affects minority students at home and school. Data from the Department of Commerce, Educational Testing Service, and other sources show that this population of students is not only the least likely to have access to computers at home, but also the least likely to gain access at school. I discuss one program, the College Reach-Out Program (CROP), which is working to overcome these inequities by exposing minority children to enriching computer activities. It is my opinion that alternative access opportunities must be created for these students, and I will review the work I did with a group of minority at-risk students and the educational program they were involved in. The project the students and I worked on gave them a different view of how computers fit into their present and future lives.

## Home Computer Ownership

There are large disparities between the access opportunities of the rich vs. poor and ethnic majority vs. ethnic minority populations. The 2000 report, *Falling Through the Net: Toward Digital Inclusion*, from the U.S. Department of Commerce is the most recent data available on home computer ownership. It is evident that gains have been made across ethnic groups in acquiring home computers. As can be seen in Figure 1, all groups have

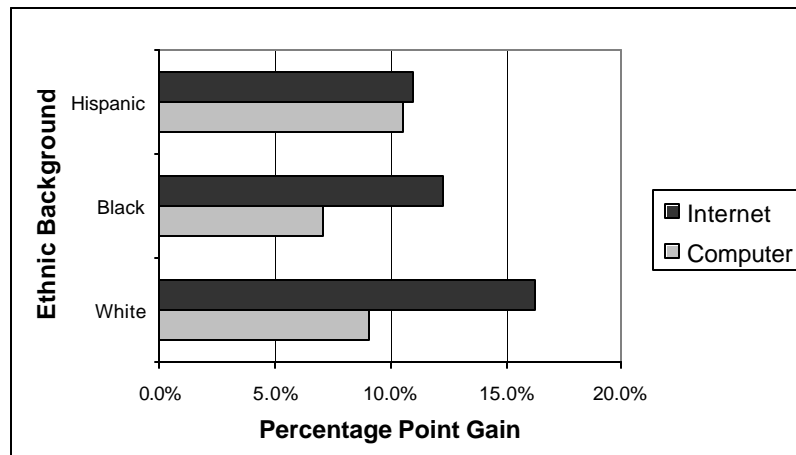


Figure 1, Gains in Computer Ownership and Internet Access, 1998-2000

experienced significant increases in home technology ownership. However, what is not immediately evident is how this growth has impacted the divide in access opportunities of different groups. The 1998 gaps between Whites and minority groups, with regard to computer ownership, still exist today. Between African Americans and Whites there was a 21.1 percentage point difference from in 1998 where there is a 23.1-point difference today. For Hispanics, the difference was 23.4 in 1998 and is 22.0 today. Therefore, even though all groups are increasing their technology acquisition, the differences in access rates have been maintained.

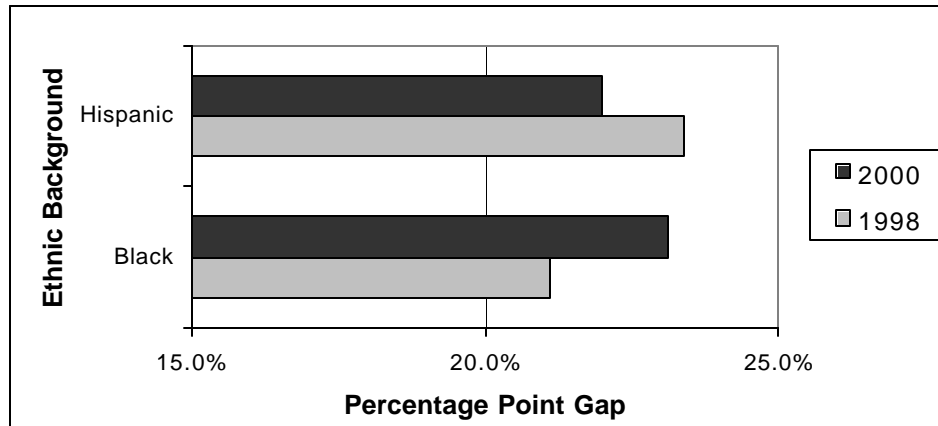


Figure 2. Change in home computer ownership gap, 1998-2000

It is not enough for a family to simply own a computer. Connection to the Internet is another confounding variable. Although, as with computer ownership, Internet access rates have increased, there are significantly fewer people who have access to the Internet than computers in the home. (Figure 3) This is not only true for the African American and Hispanic populations, but for Whites as well. Only 46.1% of Whites have Internet access, versus 55.7% that own a computer.

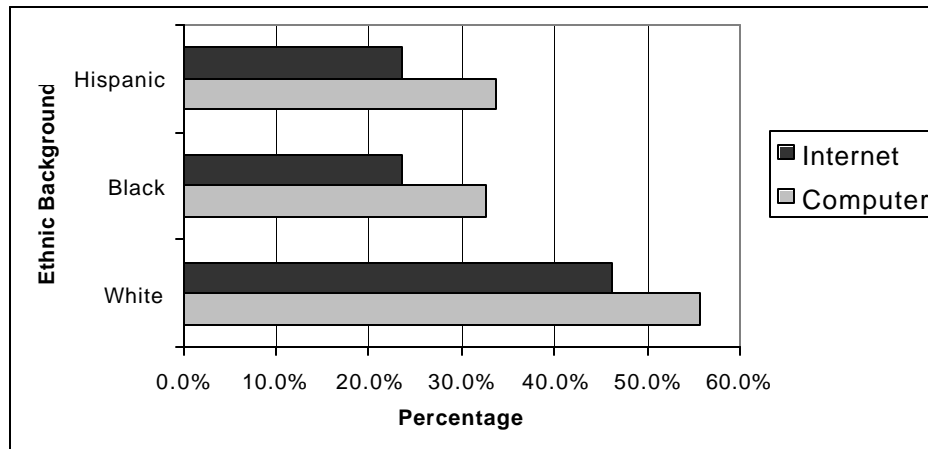


Figure 3. Computer Ownership and Internet Access, 2000

Unlike computer ownership, the gaps between Whites and minority groups regarding Internet access have not remained stable, but widened. In 1998 there was an 18.6 percentage point difference between African Americans and Whites in regard to Internet access. That difference has increased to 22.6 points. This increase has also occurred between Hispanics and Whites going from a 17.2 percentage point difference to a 22.5-point difference.

### Technology Experiences at School

It should be apparent that there are extreme inequities in computer ownership and Internet access in the home. Yet, many people believe that creating access opportunities at schools, libraries, and other public areas will counteract these inequities. However, a look at the data on computer access in schools shows that inequities exist there as well. A 1999 report from the National Center for Education Statistics reported that in schools with a minority population greater than 50%, only 37% of the instructional rooms have computers. This is compared to 57% of instructional rooms in schools with a minority population less than 6%.

In addition, the Educational Testing Service found, that the more students a school has belonging to a minority or low socioeconomic group, the higher the ratio of students to computers, peaking at 32 to 1. This is more than 7 times the recommended ratio implying that poor minority students lacking access to computers at home are also not being given equitable access at school.

The inequities associated with students and technology do not end there. Let us suppose we are in a school that has overcome the last two inequities and has a good student to computer ratio for their students. Problems still exist. Even though they may be exposed to computers on a regular basis, the types of activities they are engaged in often times deal only with low-level thinking skills. The majority of the students from the CROP program reported to me that they used computers for drill and practice and practicing standardized tests. One student even said, when asked how she uses computers in schools, "We just do what the teacher tells us to do."

I do not believe this should be their only exposure to technology. In order for students to understand how computers fit into their daily and future lives they must see computers integrated into their education. One experience that greatly influenced my belief in using technology with minority at-risk students was working with CROP 2000. This program is detailed below.

### The College Reach-Out Program

The College Reach-Out Program (CROP) is a collaborative effort of three Mid-Florida institutions of higher education—Central Florida Community College, Santa Fe Community College, and the University of Florida. The purposes of CROP are to identify and recruit economically and educationally disadvantaged students and help them move in a direction that could lead them to college. As can be seen in Figure 4, the majority of the students are African American.

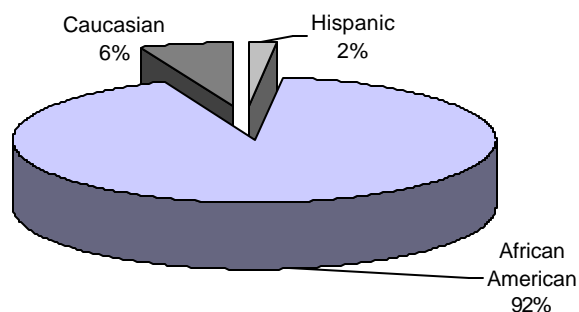


Figure 4, Ethnic Background of CROP Students

CROP is a program that functions throughout the year, but the summer is a special time for the students. Every summer, the rising 8<sup>th</sup> and 9<sup>th</sup> graders spend 5 days living on campus at the University of Florida. During that time they live in the dorms, eat in the cafeterias and interact with college students on a personal and academic level. Many current undergraduates work with the students as counselors, and are not only employed to handle disciplinary problems but to also give the students an opportunity to develop one-on-one relationships.

For their summer experience these students had the opportunity to create 1 1/2 minute movies using iMovie from Apple Computers ([www.apple.com/imovie](http://www.apple.com/imovie)). The students were encouraged to make semi-autobiographical movies, but many chose to create a story instead. The only requirement was that they make something they could take pride in presenting. After the movies were completed, they were transferred to individual VHS tapes for the children to take home. I believe that a good way to understand how to structure new activities is to look at the triumphs and tragedies of those who have done it in the past. Therefore, below is a summary of the journal that I

kept during the CROP 2000 summer program. I also include suggestions for those wanting to create their own design based on this idea.

### **CROP 2000 Technology Project**

Although I was very excited about what we would be doing I wasn't sure if they would be as excited, but the second I told them they were going to be making movies I could see the excitement on their faces. The original plan for the students was for them to bring a bunch of pictures of themselves so that they could have a variety of images in the movie, but none of the kids brought pictures. It may be useful for those who want to use photographs in projects to have the students bring in the photos days before the project is scheduled to begin. This will avoid the problem of students not having pictures to use and having to spend time looking for images.

I talked to them about what the movies were going to be about and told them what the different roles (movie director, art director, musical director, and narrator) entailed. Once they picked their roles, I brought everyone back together in order to explain more in depth what they would be doing for the remainder of the day. Handouts were distributed to explain the roles, but as is true when teaching anything, it is best to orally communicate your ideas as well as putting them on paper.

At that time they were free to work for the remainder of the hour. Most of the groups spent time talking about what they were going to do because they wanted to be able to structure their pictures around a theme. I spent my time walking around and talking to the students, and from the questions they asked I it seemed that the hardest part for most groups was developing a theme. It was refreshing to teach a computer class where the hardest part for the students was not using the computers. It became a tool for accomplishing a task instead of the task itself.

I was naïve about how smoothly the project would go and it slapped me in the face on the second day. They came with just as much energy as on the first day but seemed to get more hyperactive as the morning went on.

Since, as I mentioned before, they did not bring any photographs, they were to spend 10 minutes looking up pictures on the Internet of someone they admire. A problem, however, was that they did not know how to search the Internet. Considering that the majority of these students reported owning a home computer (71%) and using the Internet at school (55%) they did not know how to search the Internet. Instead there was a lot of "I can't find anything", and "Where can I find pictures?" Most teachers will not be working with students that they have never seen before, so they can more easily gauge student expertise. However, for those working with new students, I would suggest assuming they don't know anything. That way, if they do have knowledge coming in, it will only enhance the project as opposed to hindering it.

The last day was crunch time. Instead of allowing the kids to come into the computer lab as I usually did, I met them outside to give explicit instructions for what they needed to work on, but even with these instructions all of the groups stayed an extra hour to finish their work. After they finished, we watched the videos and they were all very proud of what they had accomplished.

### **Student Feedback**

As can be seen above, the program was not easy to organize and implement. Nevertheless, what I hope you get from this is that it can be done, and is something students will enjoy. I asked the students to write comments about their experiences working on this project. Some of the comments I received were:

- "I never knew how fun it could be making a movie on the computer."
- "It can be kind of hard, but when you put your mind into it you can do it."
- "I didn't know you could take pictures and put them on the computer."
- "I got to look at things on the computer that I usually don't look at."
- "I didn't know there was so much excitement."

These types of responses cannot be elicited when students are engaged in technology use that merely reduces them to passive clickers.

### **Jacob Riis Neighborhood Settlement House**

Community Technology Centers are one of the ways that communities nationwide are working to bridge the digital divide. These centers allow residents of communities to have access to technology as well as take classes to improve their technical skills. This community center is located in the Queensbridge Public Houses, home to 12,000 residents, 5000 of which are under the age of 18. The Community Technology Center within offers

programming for all residents of the community ranging from an after-school program to evening adult classes. My current position is as the Community Technology Center coordinator for the Jacob Riis Neighborhood Settlement House. In that position, I am responsible for developing, staffing, and scheduling all technology programs offered at Jacob Riis. One exciting program that works with children is the Our kids After-School Program.

The Our kids program is designed for students ranging in age from 5 to 10. All participants come to a technology class twice per week where they are engaged in alternative technology experiences. After-school programs are a great place to try innovative and exciting technology projects, and one project we are trying with our students uses the program Microworlds. Microworlds is an application that was developed to teach young children programming concepts in a fun and exciting way. The interface for Microworlds is kid-friendly and allows children to not only program but also draw and create imaginative projects as well.

One example of such a project is an autobiography. Our students are creating an interactive program in Microworlds that will tell their stories. In contrast to a traditional autobiography that would solely be made up of writing, our students are drawing pictures and weaving those pictures into their stories. This allows them to develop their literacy, technical, and creative skills in one setting that is fun.

### **Implications and Suggestions**

From reading the information that has been published about the digital divide and from my experiences with the CROP program and Jacob Riis, it has become abundantly clear that we are entering a time in our society where there is a new type of inequality. Computers give people access to more information than at any other time in our history. However, a large part of the population is being left behind.

No matter how you look at the data, poor and minority students are at a disadvantage concerning access to new technologies. The argument I have heard many times is that we cannot expect families who are struggling to survive to be able to afford a computer. However, what we should be more concerned with is how to engage these families through the use of technology.

We also must think about how we are using technology with minority students. When I met the CROP students, I discussed some of the things they were using computers for at school. The responses I received were quite disheartening. The majority of these students stated that they used the computer to play games or take tests. Their home use was not helping them to excel either. Most of the students in the CROP program own computers (95%), but none of them knew how to search for pictures on the Internet. Students who do not have access to high-quality computer experiences at home or school are not being provided with the opportunities they need to be successful in society. Is this the way we want to prepare students for the future?

This issue is far from being solved. There are many factors that must be taken into consideration when discussing the impact of a new technology on society, and computers are not any different. There are always those for whom it is a benefit and those for whom it is a detriment. The first step in bridging the gap is to realize that technology has not benefited everyone equally, and begin to work on ways to level the playing field. One possible solution is to expose students to innovative projects, such as the ones for the CROP program and Jacob Riis, which allow them to expand their views about how computers fit into their lives now and in the future.



## References

- Becker, H. (2000). Who's Wired and Who's Not: Children's Access to and Use of Computer Technology. *The Future of Children, 10*(2), 44-75.
- Coley, R., Cradler, J., & Engel, P. (1997). *Computers and Classrooms: The Status of Technology in U.S. Schools*. Princeton, N.J.: Educational Testing Service.
- Pearson, T. (1999). Lights, Camera, Action: Student Movies in 3 Days. *Multimedia Schools, 7*(6), 42-45.
- U.S. Department of Commerce, National Telecommunications and Information Administration (2000). *Falling Through the Net IV: Toward Digital Inclusion*. Washington, D.C.: U.S. Government Printing Office.
- U.S. Department of Commerce, National Telecommunications and Information Administration (1999). *Falling Through the Net III: Defining the Digital Divide*. Washington, D.C.: U.S. Government Printing Office.
- U.S. Department of Education, Office of Educational Research and Improvement, (1999). *Internet access in public and private schools*. (NCES Publication 2000-002). Washington, D.C.: U.S. Government Printing Office.
- U.S. Department of Labor. (1991). *What work requires of schools: A SCANS report for America 2000*. Washington, D.C.: U.S. Government Printing Office.

# Lessons Learned from a University Partnership Established to Promote the Adoption of Educational Technology: One Size Does Not Fit All

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## Introduction

The accessibility and affordability of the computer and the rapid expansion of the Internet, has put information literally at our fingertips. We are now able to procure volumes of data with just the stroke of a key. The field of technology is rapidly accelerating to allow for commonplace interactive audio, video and computer conferencing. Possibilities for communicating and exchanging information seem limited only by our imaginations.

Therefore, in order to prepare students for this swiftly changing Age of Information, the use of technology in education should become a critical factor. It is no longer enough that instruction flows from teacher to student, nor will it be enough to only expose students to technology; students must learn to become active participants in the process of their education. We need to recognize that social, political and economic changes are occurring and forcing our society to offer alternatives to traditional education. Research over the past 25 years has shown that interaction involving a purposeful cognitive approach by the student is an essential component in the learning process. Therefore, education courses need to encourage students to be self-reflective, self-corrective and self-constructive learners. Specifically, technology in education, with its "instant" availability, but more importantly, with its ability to allow learner control, is a viable solution to this need.

## Background Information

The nature of the Information/Communication Age in which we live demands that we prepare the students of today for the challenges of tomorrow. Change is occurring faster everyday and students and society are left economically and socially at risk (Lane & Cassidy, 1997). As a result, students will need to not only be prepared, but empowered. In order to increase global awareness, keep pace with and implement the rapidly changing technology, and adapt to the changes in the work force, schools need to adjust to meet these demands.

Traditionally, the teacher has been at the heart of the educational system as the deliverer of knowledge and the center of learning. However, with the onslaught of available information, teachers are no longer able to know everything of value to teach students, but are now learners along with their students. No longer isolated work units within a classroom, the teacher of today needs to facilitate the learning of the students and empower them to explore and learn by accessing the additional expert resources in the community and throughout the world (Guerra & Alvarez-Buylla, 1995). Methods and strategies involved in facilitating this process need to include guided practice, inquiry learning, and teamwork. Interaction must be a part of the learning process; however, the teacher may or may not be physically present.

Since educational technology, when properly used, forces the role of the teacher to shift, it is a natural conclusion that the role of the student must also change. For example, research shows that learners presently enrolled in distance education courses are more likely to be active listeners and are able to work independently (Trier, 1996). While motivation is a key factor, it can be increased if students feel that there is a certain relevance to the medium and the message and if they are given the opportunity to create a meaningful project from the material covered. Students will be given more initiative and have more control over what they learn. Behaviors expected of students will include being self-directed, responsible, and proactive.

In their research, Roblyer, Edwards and Havriluk (1997) note that students realize several unforeseen benefits. Slower students blossomed, less popular students were sought out for advice and assistance, and formerly unmotivated students became excited and involved. Teachers of these students observed improvements in student academic performance, self-esteem, and increased acceptance of responsibility (Roblyer, Edwards & Havriluk, 1997).

However, when any classroom is transformed because of the appropriate use of technology, it is to be expected that students need an adjustment period. Changes in the approaches to teaching and to learning will result in cognitive dissonance. Students will no longer be able to expect traditional behaviors from teachers, while simultaneously, they are readjusting to their new responsibilities.

Further, the role of the school will have to shift in order to more accurately reflect the work environment. Work environments, and the world in general, are increasingly becoming global in their operations. Contemporary society is faced not only with the problem of promoting the expansion of knowledge, but also of generating a workforce which is capable of adjusting to the Information Age. Students will need to learn more effectively and efficiently than ever before because of the rapid growth of information and because of the escalation of knowledge and skill requirements for most jobs (Wellburn, 1996).

### **The Contributions of Technology to Education**

Before technology will be adopted into the educational process, teachers must first be convinced that there is some advantage to using technology. Findings from the Apple Classrooms of Tomorrow (ACOT) research suggest that students' behaviors and attendance improved, along with attitude toward themselves and toward learning (Ringstaff, Yocam, & Marsh, 1996). Improved student performance was also noted in several ways: (1) test scores indicated that, despite time spent learning to use technology, students were performing well, and some were clearly performing better, (2) the students wrote more, more effectively, and with greater fluidity, and (3) some classes finished whole units of study far more quickly than in past years (Ringstaff, et al, 1996). Other unintended outcomes were noted which included students becoming socially more aware and more confident, students working well collaboratively, and students exploring and representing information dynamically and in many forms (Ringstaff, et al, 1996).

Educational technology makes it possible to create learning situations in which students can be engaged in activities that they find interesting and exciting for their own reasons and which accomplish the educational goals of teachers (Riel, 1989). Teachers can plan various activities simultaneously, and students can learn in an interactive, workshop-style format (Piper, 2000). Computers give teachers the opportunity to expand the boundaries of the classroom (Facemyer & Peterson, 1996, as cited in Piper, 2000) by allowing instant access to information and specialized expertise. In addition, educational technology can create new avenues for social exchange and cooperative learning (Riel, 1989).

### **Barriers to Change**

There are many factors responsible for the non-adoption of educational technology among teachers. The National Center for Education Statistics (NCES, 2000) reports that in 1999, one of the barriers most frequently reported by public school teachers was the lack of computers. If teachers are expected to use computers in the classroom, it is only logical to assume that computers will be provided. However, access alone doesn't ensure adoption of technology. Location, access, and current, compatible software play a part in determining how they will be used (Sheingold, 1991). Moreover, teachers at schools with minority students accounting for more than 50 per cent of enrollment were more likely to cite outdated, unreliable, or incompatible computers as barriers to use (NCES, 2000).

Even if the problem of access is solved, teachers must still be taught to help their students effectively use Internet resources for learning purposes. Evaluating web-based resources is an essential skill because the Internet, besides hosting a wealth of valuable educational resources, is also the single largest source of misinformation in our society (Maney, 1999).

Another barrier reported frequently by public school teachers was the lack of release time for teachers to learn how to use computers or the Internet (NCES, 2000). Franklin (1999) reports that time was the most often recorded item on the list of barriers that remain in place to prevent technology adoption. She further states that "this coincides with the President's Committee of Advisors on Science and Technology, which found teachers did not have enough time in the day to develop new lesson plans for the implementation of technology when technology was newly placed in a school" (Franklin, 1999). Chiero's (1997) study on *Teachers' Perceptions On Factors Affecting Computer Use* lists lack of time as the single most important barrier to technology adoption. Teachers must be allowed adequate time to learn new technologies (Maney, 1999). A lack of time constrains teachers from thinking about new ways of organizing learning in their classrooms by the need to handle day-to-day issues, surprises, crises and challenges (Fullan, 1999). Among other things, this daily press for time makes teachers dependent upon what they already know and prone to following routines (McKenzie, 1999).

An additional barrier reported by teachers is lack of time in the schedule for students to use computers in class (NCES, 2000). Traditional 40 or 50-minute class periods do not allow sufficient time for students to be engaged in learning through use of technology.

If teachers are going to adopt and use technology, there must be a support infrastructure available to help them troubleshoot and solve technology-related problems (Maney, 1999). This includes administrative support, technical support or advice, and support regarding ways to integrate telecommunications into the curriculum (NCES, 2000).

Other barriers to technology use as reported by the National Center on Education and Statistics (2000) from teachers' survey responses included concern about student access to inappropriate materials and inadequate training opportunities. Chiero's (1997) research confirmed that lack of adequate training is a resource frequently mentioned as a major barrier to computer use. Lack of training was the second most often reported barrier in the study done by Franklin (1999). The need for professional development continues to be a concern for public schools.

## **The Adoption Process**

The adoption of technology with instruction presents a challenge to those involved in the change business. Fullan (1999) describes the process of change as being complex, dynamic, and unpredictable. Senge (1990) defines the building process as the capacity to hold a shared common picture of the future we try to build or seek to create. A successful change agent must be comfortable dealing with ambiguities and with failure while remaining focused on the goal.

**"Situated" Change:** Failure often occurs because reform is often packaged as a "one size fits all" deal. Miller (1996) defines a situated notion of school reform as a reform that "conceptualizes restructuring of pedagogies, curricula, and school organizations as changing in purpose and form across differing educational settings and circumstances" (Miller, 1996). She stresses that the difficulties and divisiveness that often arise occur because reform efforts are generalized to all settings, rather than situated to specific setting.

In order to allow change to be situated, the process of adoption should first begin with the knowledge stage, as Rogers (1995) calls the initial stage of the adoption process. Crucial information needs to be communicated by the change agent to the educational system. Specifically, those in this field need to be aware that the use of technology in education is more than just a technological system or a tool. Instructional technology allows for its innovative capabilities to interact with the creative talents of its participants (Chute, Thompson & Starin, 1996). This information must be successfully disseminated to the users by the change agent if the goal of integration can occur. The challenge of integrating technology into schools and classrooms is really much more human than it is technological (U.S. Office of Technology Assessment, 1995).

Educators must clearly understand that technology changes the context in which education takes place (Lane & Cassidy, 1997). Teacher roles, student roles, school structures, and related issues all need to be defined prior to implementation. However, in order for any school reform to be successful, a goal is necessary, and because of the nature of the school, that goal needs to be directly related to observable student performance. It is important to remember, however, that while the objective of change is the same, the process will be different for each situation.

**Developing a Vision:** The next step toward adopting educational technology is developing a vision of how technology should influence what educators do (Costello, 1999). The educational staff must contribute to the vision. A team approach creates ownership, which in turn will promote future implementation of the plan. Ownership of the process of change is a powerful motivational strategy.

The key to effective adoption is continued dialogue throughout the process and as newer technologies become available. The premise that we are lifelong learners is a fundamental principle of distance education. Educators need to realistically evaluate the educational system with this in mind. While creating the vision is the second step, the way in which to continually promote change and growth is by maintaining and allowing for modification of the vision.

Wellburn (1996) states that schools which spend time creating an instructional vision based on instructional goals and a shared philosophy have been most successful in adopting educational technology. His findings illustrate Rogers (1995) authoritative type of Innovation-Decisions. First, Wellburn (1996) supports the fact that those in authority need to make the decision to adopt the innovation. Once the decision has been made, those whom it affects are then given the authority to determine how best to implement.

**Staff Development:** In order for the educational system to survive, it must maintain a competitive edge (Senge, 1990). Historically as well as presently, our schools have been slow in their ability to learn and to adjust to change. The evidence is seen in the rapid acceleration of the computer industry and the relatively slow rate of adoption of its technologies into the classroom.

Teachers need training and they need to be involved in the integration process. When adults see themselves as the locus of causality for their learning, they are much more likely to be intrinsically and positively motivated to change (Wlodkowski, 1993).

According to McKenzie (1998) and the U.S. Office of Technology Assessment (1995), technology training is most effective if presented to teachers in a “just in time” fashion. Teachers will learn as they need to know. Moreover, Gilmore (1995) stresses that staff development should take place in the school. An advantage to this arrangement is that learning occurs in the natural environment. Teachers will be trained with the actual hardware and software that they are expected to use.

In addition, learning along with one’s peers creates a cooperative atmosphere. This promotes more exchange of information, more helping and sharing of resources among members, more peer influence toward productivity, higher incidence of creative and risk-taking thinking, higher emotional involvement in and commitment to productivity by more members, higher acceptance and support among members, more of a problem-solving orientation to conflict management, and a lower fear of failure by members (Wlodkowski, 1993). Change will occur most quickly in environments where innovation and collegial sharing are operating simultaneously, each promoting the other (Sandholtz, Ringstaff & Dwyer, 1997).

Certain factors are needed to promote the change. Specifically, due to the perceived complexity of the any technology, an agent should identify needs and provide for leadership and support for the innovation with the teachers expected to adopt (Hutton, 1994). The change agent should also encourage partnerships to develop which would foster the adoption. This process involves identifying the categories of adopters, which in this case would be identifying those with varying degrees of computer experience.

**Technical Needs:** McKenzie (1998) emphatically states that relying on only a few technology specialists and risking the development of dependency relationships might actually delay the progress toward technology integration. In order to utilize technology effectively, teachers need immediate assistance when equipment fails. Unresolved hardware and software problems will create frustration, and if not dealt with immediately, teachers will abandon the attempt to use the technology.

If, in fact, effective technology use does enhance student learning, then rapid and appropriate incorporation of technology is essential. In a 1995 report, the U.S. Office of Technology Assessment (OTA) asserts that helping teachers use technology effectively may be the most important step to assuring that current and future investments in technology are realized. Sheingold believes that properly trained teachers make the difference between the success or failure of an integration effort (as cited in Roblyer, Edwards, & Havriluk, 1997).

## Summary

The appropriate use of technology in education is one viable solution to the challenge of training students for this Age of Information. Relatively few schools offer such a program at present. Research, although still sparse, has indicated that student achievement is comparable to traditional student achievement.

Benefits and barriers have been presented. The most logical benefits are improved student performance, behavior and an efficient manner of procuring information. An additional benefit which needs to be mentioned is the global awareness and education it easily provides for learners.

In addition to barriers referred to previously, logistics present major difficulties. Administrators and staff would need to thoroughly and elaborately organize and prepare for the implementation of technology in the classroom. Many hours would need to be dedicated to studying proper implement procedures. Hardware and software would need to be bought and installed. Space is a consideration. An ongoing needs assessment would be necessary once a program is in place. Technical support throughout would be critical to its survival.

In spite of these potential limitations, educational technology can work effectively with our school systems to properly equip our students for the future. The educational system has to be willing to change and adapt in order to not only survive, but to empower its learners to be proactive participants in this rapidly shifting world.

Experts in the use of instructional technology have suggested that there are four factors necessary to facilitate the adoption of technology. First, the process of change needs to be situated to each particular school. Second, establishing a goal is critical. Third is the necessity of staff development. Finally, technical support must be provided.

## References

- Chiero, R. T. (1997) Teachers' perspectives on factors that affect computer use. Journal of Research on Computing in Education, 30 (2), 133-143.
- Chute, A. G., Thompson, D. P. & H. D. Starin. (1996). It's time to change the way we train! [On-line]. Available: [www.lucent.com/cedl/itstime.html](http://www.lucent.com/cedl/itstime.html)
- Costello, R. W. (November 1997). The leadership role in making the technology connection. THE Journal [online] 5 pages. Available: <http://www.thejournal.com/journal/magazine/97/nov/feat4.html>
- Franklin, T. J. (1999). Teacher computer access, student computer access, years of teaching experience, and professional development as predictors of competency of K-4 Ohio Public Schools students on the National Educational Technology Standards. Unpublished doctoral dissertation, Ohio University, Athens, OH.
- Fullan, M. (1999). Change forces: Probing the depths of educational reform. New York: The Falmer Press.
- Gilmore, A. M. (1995). Turning teachers on to computers: Evaluation of a teacher development program Journal of Research on Computing in Education, 27, 251-269.
- Guerra V. & C. Alvarez-Buylla. (1995). The turning point for distance education. In B. S. Dunning and V. V. Pittman (eds.), Distance education symposium 3: Policy and administration (pp. 51-56). University Park: The Pennsylvania State University.
- Hutton, D. W. (1994). The change agent's handbook. Milwaukee, WI: ASQC Quality Press.
- Lane, C. & S. Cassidy. (1997). The role of technology in the systemic reform of education and training, Part 11. [On-line]. Available: [www.fwl.org/edtech/reformtechpart11.html](http://www.fwl.org/edtech/reformtechpart11.html)
- Maney, J. K. (1999). The role of technology in education: Reality, pitfalls, and potential. In G. Cizek (Ed.), The handbook of educational policy (pp. 387-415). San Diego, CA: The Academic Press.
- McKenzie, J. (1998, March). Secrets of success: Professional development that works. eSchool News [online] 11 pages. Available: <http://www.fromnowon.org/eschool/secrets.html>
- McKenzie, J. (1999). How teachers learn technology best. Bellingham, WA: FNO Press.
- Miller, J. L. (Spring 1996). Teachers, researchers, and situated school reform: Circulations of power. Theory into Practice, 35 (2) 86-92. Columbus, OH: The Ohio State University.
- Piper, D. M. (2000). Facilitating change: Factors influencing teachers' practices of using computers in the classroom. Unpublished doctoral dissertation, Indiana University of Pennsylvania, Indiana, PA.
- Riel, M. (1989) The impact of computers in classrooms. Journal of Research on Computing in Education, 27 (2), 180-190.
- Ringstaff, C., Yocam, K. & Marsh, J. (1996). Integrating technology into classroom instruction: An assessment of the impact of the ACOT teacher development center project. Apple Classrooms of Tomorrow [online] 18 pages. Available: <http://www.apple.com/education/k12/leadership/acot/library.html>
- Roblyer, M. D., Edwards, J. & M. A. Havriluk. (1997). Linking to learn: Using technology to connect people and resources. In Integrating educational technology into teaching (pp. 211-237). Upper Saddle River, NJ: Prentice-Hall.
- Rogers, E. M. (1995). Diffusions of innovations (4th ed.). New York, NY: The Free Press.
- Sandholtz, J. H., Ringstaff, C., & Dwyer, D. C. (1997). Teaching with technology: Creating student-centered classrooms. New York: Teachers College Press.
- Senge, P. M. (1990). The fifth discipline. New York, NY: Currency Doubleday.
- Sheingold, K. (1991). Restructuring for learning with technology: The potential for synergy. Phi Delta Kappan, 73, 17-27.
- Trier, V. (Ed.). (1996). Distance Education Research, (Guide #10). Idaho: University of Idaho Engineering Outreach. Available: [www.uidaho.edu/evo/dist10.html](http://www.uidaho.edu/evo/dist10.html)
- U.S. Congress, Office of Technology Assessment. (1995) Teachers and technology: Making the connection. Washington, DC: U.S. Government Printing Office.
- U.S. Department of Education, National Center for Education Statistics. (2000). Teachers' tools for the 21<sup>st</sup> century: A report on teachers' use of technology. Washington, D.C.: U.S. Government Printing Office.
- Wellburn, E. (1996). The status of technology in the education system: A literature review. [On-line]. Available: [www.etc.bc.ca/lists/nuggets/EdTech\\_report.html](http://www.etc.bc.ca/lists/nuggets/EdTech_report.html)
- Wlodkowski, R. J. (1993). Enhancing adult motivation to learn. San Francisco: Jossey-Bass

# Moving Beyond the Training Environment to a Vision of Technology Integration in the Classroom Curriculum: Implications for Practice

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## Abstract

*Most teachers have little experience integrating technology into their students' learning processes and typically do not have models on which to build their own visions of an integrated classroom (Beichner, 1993; Cifuentes, 2001; Kerr, 1996; Schrum, 1999; Studler & Wetzel, 1999). Teachers participating in technology training must move beyond training classrooms to apply teaching methods that facilitate technology integration in their classrooms.*

*The purpose of this study was to determine to what extent teachers (a) alter their teaching methods and (b) integrate technology into their classroom curriculum during, and after a technology training course designed to prepare teachers to use technologies that support their teaching and student learning.*

*The eight cases studied illuminated the processes of technology integration for elementary and secondary teachers possessing low and high levels of technology skill and use. Through the results of this study, instructors will understand better how to facilitate training in the integration of technology for different types of teachers. The study identified implications for future studies involving technology integration training and processes of integrating technology in the curriculum.*

## Theoretical Framework

In order to investigate the processes that occur during and after technology training as individuals integrate technology into their classroom curriculum, an understanding of the current educational system as it relates to technology and teaching practices must be established. The goals of restructuring the current educational system were reviewed to gain understanding of the shift from the traditional role of teachers as purveyors of knowledge to a role that allowed for the establishment of a more learner-centered environment and the role that technology would have in establishing these new roles and supporting the new learning environments (Goals 2000, 2000; Technology Assessment [OTA], 1995; Texas Long Range Plan, 1996). The theoretical foundations of this study are therefore based on a conceptual understanding of: (a) the goals of restructuring; (b) the role of technology in restructuring; (c) the changing roles of teachers; (d) teacher training; (e) barriers to technology integration; and (f) the implementation process.

Training teachers in the processes of integrating technology must replace current practice of simply training teachers in computer applications (Brownell, 1992; Ertmer, 1999; Roblyer, Edwards, & Havriluk, 2000; Schrum, 1999; Simonson & Thompson, 1997). Teachers determine what happens in the classroom and how innovations are or are not implemented (Sandholtz, Ringstaff, & Dwyer, 1997). Therefore, if teachers are to move beyond the training environment to implementation in their classroom, they must be prepared to overcome obstacles that interfere with the process. Effective training programs are needed to provide teachers with models to build their own visions of an integrated classroom (Beichner, 1993; Cifuentes, 2001; Kerr, 1996; Schrum, 1999; Studler & Wetzel, 1999).

## Methods

Case study methods (Wiersma, 1995) were applied to gain an understanding of the experiences of teachers as they moved through an OL or F2F course designed to prepare teachers for integrating technology into the curriculum. Complementary data collection processes (Shulman, 1986) were used in each of the eight cases to provide depth and breadth in identifying and analyzing the barriers and processes affecting the impact of the training course. In this study, the integration of survey, interview, and observational approaches offered the researcher an opportunity to develop a complete analysis of participant behavior from a holistic perspective (Gall, Borg & Gall, 1996).

## Data Sources

*INST 6031: Applications of Technology*, a core graduate-level course offered by the School of Education at the University of Houston – Clear Lake, introduced students to the tools and skills necessary to understand and operate computers, navigate the Internet and World Wide Web, and create hypermedia products. The course included educational applications of instructional and information technologies to promote the integration of technology into the curriculum. Emphasis was on the comprehensive integration and implementation of the Technology Applications Texas Essential Knowledge and Skills (Texas Education Agency, 2001), Secretary's Commission on Achieving Necessary Skills (SCANS) 2000 report (U.S. Department of Labor), and those tools that have important implications for the creation of products with the technology. The course was offered either in an OL format or in a traditional F2F setting. Within both delivery methods, a combination of hands-on lab assignments and content material was offered through a student-centered approach.

The PK-12 teachers enrolled in all sections of the graduate level *INST 6031: Applications of Technology* course at University of Houston – Clear Lake made up the pool of 30 participants. A computer use survey was administered and collected prior to any classroom instruction. The survey scores were based on a point value associated with the level of skills selected by the individual, levels 1 - 4 were given point values of 1 - 4 accordingly, no response resulted in zero points for that question. The participants were divided into two groups, which were representative of the participants' teaching grade levels Elementary (PK-6) and Secondary (6-12). The Elementary and Secondary groups were then divided by course delivery method. The two course delivery methods under investigation were OL and F2F. Therefore, the cases for investigation were selected from a sample of Elementary – OL, Elementary – F2F, Secondary – OL and Secondary – F2F. A systematic sample using circular lists, rank ordered by skill level from highest to lowest composite score, was used to ensure representation of varied technology skill levels within the grade levels.

## **Results**

Initial attempts at integrating technology indicated all of the teachers used technology in ways that replicated their current teaching practices, which meant six of the eight participants created teacher-directed technology-based lessons. Those who developed learner-centered integrated lessons followed more constructivist principles in the classroom. Their classrooms were learner-centered environments that focused on discover and problem solving.

During the final observation all teachers used technology tools that were learner-directed in application, although many of the activities still perpetuated the teacher-directed environment. Those who had consistently used constructivist principles in their teaching continued to develop learner-centered activities that incorporated technology.

During Web-based activities students were responsible for obtaining, synthesizing, and reporting on information obtained from the Internet. In the three classrooms that used a Web-based activity during the final observation, student engagement increased, discipline problems declined, and the teachers' role changed from the sole provider of knowledge and skills to one of facilitator or guide.

The researcher found several intrinsic and extrinsic factors that affected the integration of technology. Lack of technical support was consistent on seven of the eight campuses. The campus with onsite support personnel who assisted the teacher in locating resources, preparing the computer for student use, and assisting during the technology-based lesson, moved to a higher level of collaboration among the teachers on campus than the other observed campuses. Additional barriers beyond the control of the teachers or the researcher were created by (a) an emphasis on a fixed curriculum that supported TAAS and End of Course objectives, (b) a lack of technology training, and (c) insufficient resources.

Teachers' use of technology was directly impacted by district and campus level policies. The teacher in the one-computer classroom was hindered by policy that restricted use of the computer to the teacher only. The restricted use affected the ability of the teacher to move beyond teacher-directed instructional uses of the computer. This was especially true of Internet access, which mandated that all Internet-based activities conducted in the classroom had to be directed by the teacher at all times.

There were no noted differences between the growth in skill levels of the teachers involved in the OL section of the course and those in the F2F section. There were differences between the OL section and the F2F section in their identified Stages of Concern. Only the F2F section teachers indicated increased concerns about collaboration (Stage 5). Only the OL section teachers indicated increased concerns about modifications or alternatives to technology integration.

When comparing across the two groups, the level of use was a greater among those teachers enrolled in the F2F section of the course than those enrolled in the OL section. This could indicate that the F2F population



benefited from the ability to see and interact with technology integration in an environment that closely resembled their own classroom settings.

The teachers in the F2F section used cooperative groups and demonstrations more frequently than the teachers enrolled in the OL section. This is consistent with research on the influence past learning experiences have on current teaching practices because the F2F group had increased opportunity for cooperative group work and the OL section relied on demonstrations for a large percentage of their content materials (Dwyer, Ringstaff, & Sandholtz, 1990a, 1990b). Classroom management for the F2F and OL section teachers was consistent with that of the other groups. Both groups indicated improvements in classroom management with the use of technology.

Elementary and Secondary teachers varied in their growth in skills and knowledge of basic and advanced computer use but were similar in those related to Internet use. The two groups were similar in their identified Stages of Concern. Both groups focused early on informational (Stage 1) and personal (Stage 2) concerns. The majority of teachers in each group indicated increased levels of concern over time for the consequences of using technology with their students (Stage 4). The Secondary group contained a higher percentage of teachers with time, logistics, and management concerns (Stage 3).

The levels of use of the teachers in the Elementary group increased by a higher margin than that found in the Secondary group.

Initially the two groups varied in their preferred methods of instructional delivery. By the end of the semester the two groups were closely aligned in their uses of instructional methods.

The teachers in both groups indicated improvements in classroom management with the use of technology, citing increased student engagement with technology. The need for discipline was reduced in both groups. Student assessment was more manageable when the students were interacting with the technology.

There were not dramatic differences in initial skill levels between the High Skill and Low Skill level groups. The biggest difference in the initial scores was in Teacher Internet Use (Part C). While both groups focused early on informational (Stage 1) and personal (Stage 2) concerns, only the Low Skill level teachers indicated increased levels of concern over time for the consequences of using technology with their students (Stage 4). Both groups indicated increased concerns about collaboration (Stage 5). Both groups indicated low levels of concern related to time, logistics, and management concerns (Stage 3).

When compared across the two groups of teachers, it appears that the Level of Use was most impacted by initial Level of Use and increased skill levels over time. Teachers at the Low Skill level encountered higher levels of technical difficulties that required assistance from the researcher to resolve. The lack of onsite assistance directly impacted their ability to use technology without additional support.

The High Skill teachers indicated they used a wider variety of instructional methods on a regular basis. After training the two groups were more closely aligned with the Low Skill teachers now indicating increased frequency of a wider variety of methods. Indicating that as skills and knowledge increase the individuals' choice of instructional methods were expanded.

In summary, the results of this study indicate that the individual characteristics of the teachers, the content area they teach, their previous teaching experience, their career goals, and their classroom environment have an impact on how and to what degree they integrate technology into their classroom curriculum during and after training in the processes of technology integration. A course designed to train teachers in technology skills and technology integration raises the skill levels of the teachers, increases the use of technology in the classroom but the course in this study did not alter the teachers' established teaching methods. This researcher hypothesizes that such alterations require a more comprehensive effort than one class.

## **Discussion**

The teachers in this study possessed unique sets of skills and knowledge related to computer use, Internet use and technology integration. Concerns were individualized and personal, often directly linked to their campus environment, their previous educational training, their prior teaching experience, and their career goals. Levels of use reflected skill and knowledge growth as well as the access and availability of technology within the school environment. Instructional methods were used that met the needs of content, students, and personal preference. Classrooms were managed in ways that modeled the classrooms of the individuals' past educational experiences.

During the course, the teachers obtained instruction in basic use and technology integration. However, their skill growth did not reflect the amount of training received but instead reflected the individuals' initial skill levels and opportunities to reinforce the new knowledge through practice and application. Therefore, teacher preparation programs need to integrate technology throughout the program and not restrict technology instruction to one course; one course is not enough.

I observed uses of technology in the classroom that replicated the activities in the course and sought to mimic the existing teaching practices of the individual teacher. The teachers who adhered to teacher-directed principles were unable to create a vision for technology integration in their classrooms, while those who followed a more constructivist approach to instructional delivery were able to envision technology as a tool that would enhance the teaching and learning process.

Teachers need more experiences with technical skills and knowledge if they are to develop a vision for technology integration within their own individualized environment. They need models of effective teaching practices that integrate technology. They need access to resources that promote or support technology integration in the curriculum. They need to experience technology integration in environments that closely resemble their own classrooms; and they need opportunities to practice technology integration in their classrooms with the necessary levels of technical and administrative support.

If teacher educators are to facilitate technology integration for different types of teachers, they need to design and implement learning environments that (a) are learner-centered, (b) encourage collaboration, (c) promote discovery, and (d) provide activities that are engaging and relevant to the individual needs and environments of the learners. Teachers will develop visions of technology integration based on their own educational experiences. Therefore training programs must provide rich extended experiences in technology integration and model effective practices and innovative uses of technology that improve teaching and learning.

## References

- Beichner, R. J., (1993). Technology competencies for new teachers: Issues and suggestions. *Journal of Computing in Teacher Education*, 9(3), 17-20.
- Brownell, G. (1992). *Computers and teaching* (2<sup>nd</sup> ed.). New York: West Publishing Company.
- Cifuentes, L., Sanders, B., & Willis, J. M. (2001). *A technology rich secondary classroom: The workstation model*. Unpublished manuscript, Texas A&M University, College Station.
- Dwyer, D. C., Ringstaff, C., & Sandholtz, J. H. (1990a). *Teacher beliefs and practices: Part I. Patterns of change* [Apple Classrooms of Tomorrow Research Report No. 8]. [On-line] Available: <http://www.apple.com/education/k12/leadership/acot/library.html>
- Dwyer, D. C., Ringstaff, C., & Sandholtz, J. H. (1990b). *Teacher beliefs and practices: Part I. Support for change* [Apple Classrooms of Tomorrow Research Report No. 9]. [On-line] Available: <http://www.apple.com/education/k12/leadership/acot/library.html>
- Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development*, 47(4), 47-61.
- Gall, M. D., Borg, W. R., & Gall, J. P. (1996). *Educational research: An introduction* (6<sup>th</sup> ed.). New York: Longman Publishers USA.
- Kerr, S. T. (1996). Visions of sugarplums: The future of technology, education, and the schools. In S.T. Kerr (Ed.), *Technology and the future of schooling: Ninety-fifth yearbook of the National Society for the Study of Education*, (part 2), (pp. 1-27). Chicago: University of Chicago.
- Office of Technology Assessment. (1995). *Teachers and technology: Making the connection*. Washington, DC: Government Printing Office.
- Roblyer, M. D., Edwards, J., & Havriluk, M. A. (2000). *Integrating educational technology into teaching* (2<sup>nd</sup> ed.). Columbus, OH: Merrill.
- Sandholtz, J. H., Ringstaff, C., & Dwyer, D. C. (1997). *Teaching with technology: Creating student-centered classrooms*. New York: Teachers College Press.
- Schrum, L. (1999). Technology professional development for teachers. *Educational Technology Research and Development*, 47(4), 83-90.
- Secretary's Commission on Achieving Necessary Skills. (1991). *What work requires of schools. A SCANS report for America 2000*. Washington, DC: U.S. Department of Labor.
- Shulman, L. S. (1986). Paradigms and research programs in the study of teaching: A contemporary perspective. In M. Wittrock (Ed.), *Handbook of research on teaching* (pp. 39-36). New York: MacMillan.
- Simonson, M. R., & Thompson, A. (1997). *Educational computing foundations*. Upper Saddle River, NJ: Merrill.
- Strudler, N., & Wetzell, K. (1999). Lessons from exemplary colleges of education: Factors affecting technology integration in preservice programs. *Educational Technology Research and Development*, 47(4), 63-81.
- Texas Education Agency (2001). *Texas Essential Knowledge and Skills*. Austin, TX: Author.
- Texas State Board of Education (1996). *Long-range plan for technology (1996-2010)*. Austin, TX: Publications Office, Texas Education Agency.

- U.S. Department of Education. (1998). *Goals 2000: Reforming education to improve student achievement*. Washington, DC: Author.
- Wiersma, W. (1995). *Research methods in education: An introduction* (6<sup>th</sup> ed.). Boston: Allyn and Bacon.

## **The evidence for InTech: What does research say about Georgia's required technology training?**

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In 2000, the Georgia Legislature mandated that all certified school personnel complete the Georgia Framework for INtegrating TEChnology in the Student-Centered Classroom (InTech) or approved alternatives. InTech is a constructivist-based technology-training program. It was developed as a statewide staff development initiative by the Georgia Department of Education in 1997, and was implemented in 1998. The purpose of this paper is to provide information about this initiative to improve teaching and learning through technology. Included are a problem statement, brief summaries of three dissertation research studies investigating the influences of InTech, and recommendations regarding similar initiatives.

### **Statement of the Problem**

Since 1993, the state of Georgia has invested over \$337 million in support of its belief that providing educational technology for classrooms offers effective ways to improve schools and to help students learn (Brackett, Henry, & Weathersby, 1999). It has been reported that Georgia schools have 210,885 computers, with 98 percent having Internet access and 49 percent equipped with local area networks (Coley et al, 1997; Georgia Department of Education, 2000). The FY 2001 Georgia education budget included \$29,485,875 funding for computers (Sherrord, 2000).

Availability of technology is one issue; its use is another (Byrom, 1998). To prepare teachers to integrate technology, student learning, and academic goals, the Georgia Framework for INtegrating TEChnology in the Student-Centered Classroom (InTech) was designed as staff development training in technology. Its overall goal was to provide a catalyst for fundamental changes in the teaching and learning process. Instruction in this program is constructivist-based and is expected to lead participants to development of constructivist teaching philosophies, characterized by a shift to more student-centered learning (Holmes et al., 1998). InTech activities are designed to promote active, problem-based learning opportunities that can be transferred to participants' classrooms.

Since its introduction in 1998, numerous Georgia school systems voluntarily have implemented InTech and over 15,000 Georgia educators have been trained through the program. In 2000, Governor Roy Barnes signed into law Georgia House Bill 1187 (The A Plus Education Reform Act of 2000) which mandates that all Georgia teachers and administrators seeking certification or certificate renewal must complete successfully the InTech training program or demonstrate competency in ISTE computer skill standards through alternatives approved by Georgia's Professional Standards Commission.

This state-sponsored initiative was enacted to improve Georgia's schools and to enhance student learning; however, decisions for the ongoing commitment were made without empirical support. To address the specific need for research examining the influences of InTech and the general need for research examining the most effective ways to implement changes necessary for integrating technology into the curriculum, three doctoral candidates at Valdosta State University (VSU) conducted dissertation studies of InTech. Variables of the three studies include: perceived levels of technology integration, accessibility to technology, administrative support, teacher integration of technology, student utilization of technology, teacher and administrator beliefs related to technology use. Summaries are given below.

### **InTech Training, Technology Integration, and Administrative Support of Technology: Perceptions of Elementary School Teachers.**

**By Lynn Minor**

InTech has been offered to teachers in the Valdosta State University (VSU) service region for the past three years through the VSU Educational Technology Teaching Center (ETTC). However, the extent to which InTech training at the VSU ETTC or through the redelivery program affects the technology integration of teachers was largely unknown. Redelivery is a term used to refer to a model of implementing InTech training in which teachers receive trainer-of-trainers instruction at the ETTC and return to implement InTech with teachers in their own school. This quantitative research study was conducted to evaluate the effectiveness of Phase One of the Elementary InTech Professional Development Program offered at Valdosta State University. The purpose of the investigation was to examine perceived levels of technology integration of elementary school teachers as a function of the InTech training model received and to determine whether a relationship was present between perceived levels of administrative support and technology integration. Accessibility to technology in the classrooms of the participants was also investigated.

## Methods

Data for this study were collected using a questionnaire, titled Technology Integration Survey for Teachers, that was adapted from the Student Achievement Survey used by the Bernie School District (1999). Twenty-six questions concerning teachers' perceptions of technology use in their classrooms, accessibility of technology in the classroom, and administrative support for technology integration in their schools were included on the instrument. Participants were selected using purposive sampling to include teachers in the Valdosta State University (VSU) Educational Technology Training Center (ETTC) service area who teach at elementary schools with the following three groups of teachers: teachers who received InTech training at the VSU ETTC, teachers who received InTech training through the redelivery model at their own school, and teachers who have not received InTech training. Twenty-six elementary schools, representing 9 of the 45 school districts in the VSU ETTC service area, met the criteria for this study. Completed surveys were received from 630 of the 993 possible participants, representing a response rate of 63%.

## Results

Responses to sixteen Likert-type survey items were combined to calculate the perceived level of technology integration. A one-way analysis of variance (ANOVA) was conducted to determine whether an overall difference in the perceived level of technology integration was present as a function of the InTech training model. Statistically significant differences were found for perceived levels of technology integration with a main effect of  $F(2, 610) = 66.28, p < .0005$ . Teachers who received training at the VSU ETTC ( $M = 50.69$ ) perceived their level of integration as significantly higher than did teachers who received training through the redelivery model ( $M = 46.15$ ) and teachers with no InTech training ( $M = 37.41$ ). Furthermore, a statistically significant difference was also found in the perceived level of technology integration between teachers who received InTech training through the redelivery model and those with no InTech training. Calculation of eta squared yielded an effect size of .47. According to Cohen, (1988), a large effect is represented by these results.

Additional information pertaining to teachers' perceived levels of technology integration was gleaned by analyzing responses to survey items concerning accessibility to various types of technology in their classrooms. Pearson chi-square tests were conducted for each possible response to determine whether statistically significant differences were present among the three groups of teachers. Statistically significant differences in access to a scanner, more than one multimedia computer, and a scan converter and television were found with more VSU ETTC InTech teachers reporting access to these than redelivery and non-InTech teachers. In addition, more redelivery teachers reported access than did non-Intech teachers. However, more teachers who received training through the redelivery model and teachers with no InTech training reported having one multimedia computer than did teachers trained at the VSU ETTC. Interestingly, a higher percentage of redelivery InTech teachers reported having access to a digital camera than did VSU ETTC InTech teachers and non-InTech teachers. No statistically significant difference was found among the three training groups for access to a laser disk player.

Teachers' responses to five Likert-type survey items were combined to calculate perceived levels of administrative support. A statistically significant relationship was found between perceived administrative support and levels of technology integration. Use of a Pearson  $r$  yielded the following:  $r(613) = .23, p < .0005$ . Squaring the correlation provided evidence that 5.29% of the variance was shared between the perceived levels of administrative support and technology integration. According to Gay and Airasian (2000), this coefficient indicates a weak relationship.

## Conclusions

Phase One of Elementary InTech training has had favorable effects on technology integration in the classrooms of elementary teachers who received this training. Teachers who received InTech training through the VSU ETTC indicated higher levels of technology integration than did teachers who received InTech training through the redelivery model and teachers with no InTech training. Furthermore, a statistically significant relationship was found between the perceived levels of administrative support and levels of technology integration. Although this finding represented a weak relationship, administrative support of technology professional development, and integration is recommended. Administrators can provide support for technology integration by arranging for teachers to participate in professional development, making technology accessible in classrooms, and modeling the use of technology.

## Teachers' and Administrators' Beliefs Regarding Constructivist-Based, Exemplary Practices for Technology Integration in Middle School Classrooms

By Fritzie Sheumaker

Introducing technology into classrooms as key components in the teaching and learning process involves more than providing hardware and software. The use of technology must coincide with how students learn best (National Council for Accreditation of Teacher Education Task Force on Professional Development [NCATE], 1997). Because the constructivist use of technology engages students in the learning process and helps them build new ideas (Jonassen, Peck, & Wilson, 1999) constructivist philosophy provides the foundation for effective strategies for teaching with technology (Strommen & Lincoln, 1992).

InTech was designed to help both teachers and administrators develop constructivist-based pedagogies and use technology as part of broader educational change and reform efforts (Holmes et al., 1998). While teachers make technology use work in classrooms (Anderson & Harris, 1997, Becker, 1999, 2000; Saye, 1998), administrators are essential to organizational change in schools (Bennett, 1996, Lambert, 1998, Stanley et al., 1998). The building principal was found to be the change agent responsible for implementing technology integration and to be an important factor in creating momentum toward exemplary technology use, constructivist practice, and improved learning for students.

Because no studies were found on the effectiveness of Georgia's InTech professional development model in promoting comparable teacher and administrator beliefs, the purpose of this study was to assess the effect of participation in InTech training on middle school teachers' and administrators' beliefs regarding constructivist-based, exemplary uses of classroom technology.

## Methods

A causal-comparative research design was used, and participants included 342 teachers and 29 administrators from 10 Southwest Georgia Middle Schools. Data were gathered from each participant's responses on the Technology and Teaching Practices Survey (TTPS) and were analyzed through analysis of variance procedures. In a process labeled as qualitative contrasting case analysis (Onwuegbuzie & Teddlie, in press), qualitative data were collected through interviews with two teachers and two administrators identified on the basis of their quantitative survey scores. The selection of the interview participants was based on extreme TTPS scores with high constructivist being those respondents with a mean score greater than 5.0 and low constructivist those whose mean scores were less than 3.0.

## Results

A factor analysis of participant responses on the TTPS revealed three factors related to constructivist beliefs: (a) Nature of Classroom Instruction (NCI), (b) Nature of Classroom Roles (NCR), and (c) Nature of Knowledge and Evaluation (NKE). A score was also calculated from two additional items as an indication of participants' Comfort with Using Computers (CCI). Based on the view of Feng (1995) that educators may adhere to constructivist beliefs in varying degrees, cut points for the total TTPS mean were established. An examination of the distribution of scores revealed a normal curve, and the means were then coded into a new variable labeled as Constructivist Category. A mean score between 2.00 – 3.00 indicated a participant could be termed a "Traditionalist." A mean score of 3.01 – 4.99 or 5.00 – 6.00 identified a participant as "Emergent-Constructivist" or "Active-Constructivist", respectively.

A statistically significant relationship was found between respondents' InTech status and constructivist category. With regard to all InTech-trained teachers and administrators, 11% scored at the Active-Constructivist level and 88% as Emergent-Constructivist. When only teacher respondents were considered, there was also a statistically significant relationship between InTech status and Constructivist Category with 89% of InTech-trained teachers ranked as Emergent-Constructivist and 11% as Active-Constructivist. There was no statistically significant relationship between administrators' InTech status and their Constructivist Category.

Statistically significant differences were found based on the total TTPS mean and the NCI, NCR, and CCI subscale scores between the constructivist-based beliefs of InTech trained teachers and administrators and non-InTech trained teachers and administrators. InTech-trained teachers also had statistically significantly higher scores than their non-InTech-trained counterparts on the total TTPS and the NCI and NCR subscales. However, InTech training did not appear to have the same influence on the constructivist-based beliefs of participating administrators. No statistically significant differences were found in administrators' scores on the TTPS total score, nor the NCI, NCR, or NKE subscales. InTech-trained administrators did have statistically higher scores on the CCI subscale than non-InTech-trained administrators.

Analysis of the interview data from a Traditionalist Teacher, a Traditionalist Administrator, an Active-Constructivist Teacher, and an Active-Constructivist Administrator revealed that a school-wide shared vision for the nature of technology integration appeared to be the most influential factor contributing to teachers' and administrators' views being more or less congruent with constructivist philosophy. Other factors identified as contributing to a respondent's constructivist views were: (a) the degree of emphasis given to standardized testing when curricular and instructional decisions were made; (b) the degree of administrative support for constructivist-based instructional practices; (c) the level of comfort a respondent had with student-centered classroom roles, (d) the level of support for performance-based classroom assessments, and (e) how standardized testing demands were balanced with technology use. Both teachers and administrators viewed InTech as a factor contributing to their comfort with using computers for classroom instruction.

## **Conclusions**

The results of this study are an indication that InTech training is beneficial to middle school teachers and administrators who complete it and may increase the likelihood that participating teachers and administrators will share a vision for effective technology use. Moreover, constructivist-based beliefs are present among teachers and administrators in Southwest Georgia middle schools with the majority of study participants scoring in the Emergent-Constructivist Category. However, concerns about student performance on standardized tests may decrease the support for and use of constructivist-based teaching strategies. Constructivism is not an end to itself; its value lies in its capacity to have a positive influence on student learning (Feng, 1995). To strengthen commitment to constructivist-based, exemplary uses of classroom technology, improving student learning outcomes should be an essential focus of the skills and beliefs promoted by InTech.

## **The Effectiveness of a Constructivist-Based Professional Development Technology Integration Program in Increasing Technology Utilization By Rachelle Fowler**

With the increasing availability of technology in the school systems, a key issue educators must address is the effective integration of technology into the curriculum. Although many current educators completed their professional training before the technological age in education, they are compelled to use technology that most find unfamiliar and intimidating (Armstrong, Davis, & Young, 1996). To address teachers' needs for technology skills, numerous Georgia school systems have implemented staff development training in technology through InTech, a constructivist-based professional development technology integration program. Although Georgia has taken steps to encourage teacher proficiency in the use of technology, such proficiency may not be enough to affect student use of technology in the classroom. The purpose of this study was to investigate both teacher and student utilization of technology in the academic classrooms of teachers who have or have not been trained in a constructivist-based professional development technology training program such as the state-sanctioned InTech model.

## **Methods**

The research study utilized a mixed methods design. Quantitative data were collected through teacher and student surveys, teacher logs of technology use, and computer lab and media center sign-in sheets. Qualitative data

were collected through teacher/student interviews and classroom observations. Subjects for the study included 65 teachers and 265 students at a comprehensive high school located in rural Southwest Georgia.

## **Results**

Both quantitative and qualitative analysis of data indicated an increase in the use of technology. Teachers in the group who had been trained through the InTech model utilized technology for teacher-related tasks more frequently than they did prior to training. Data analysis revealed an increase in the use of technology for student management of grades, student information, school management, word processing, databases and spreadsheets, desktop publishing, multimedia/authoring, instructional demonstration and tutoring, information retrieval, Internet, web page development, and e-mail. Trained teachers also utilized technology more frequently for teacher-related tasks in some categories than untrained teachers. Data analysis revealed an increase in the use of technology for spreadsheets and databases, instructional demonstrations, word processing, and Internet access.

Congruently, students enrolled in the classes of trained teachers were required to use technology more frequently than they were prior to teacher training. Data analysis revealed an increase in the use of technology for computer-assisted instruction for simulations and educational games, word processing, information retrieval, databases and spreadsheets, Internet access, and electronic presentations. Students enrolled in classes of trained teachers were also required to use technology more than students in the classes of untrained teachers. Data analysis indicated a significant increase in the use of word processing, electronic presentations, and Internet access for students of trained teachers. Teachers from both groups, who required students to use technology, employed constructivist-based principles in their assignments.

## **Conclusions**

Based on the results of analyses of quantitative and qualitative data, InTech, a constructivist-based model of professional development for technology integration training, increases both teacher and student utilization of technology. However, many factors influence the degree to which technology is implemented in a school system. Because of the importance of technology in our highly technological society and global economy, educators should continue to investigate the most effective ways to implement changes necessary for integrating technology into the curriculum.

## **Recommendations**

The recommendation for more research is a given for the conclusion of any review of research literature. The three studies described in this paper, although all investigated InTech, were quite diverse. Three school levels, elementary, middle and high school were represented in the studies. Multiple factors in relation to technology integration training were researched, including delivery models, administrative support and student use of technology. The InTech program, in its past and current implementations, is rich ground for further empirical research, for ongoing and accurate evaluation research, and for action research in the Educational Technology Training Centers and the schools where InTech lives its daily life.

More research is not the only need; there is also a need and a promise for more InTech, or alternatives to the program. As the state supported solution to legislatively mandated technology competencies for educational personnel, there is tremendous pressure to make InTech available to very large numbers of educators in a relatively short period of time. This pressure on individuals and organizations has generated controversial discussions about the suitability of InTech training as the 'magic bullet' that will solve the technology integration 'problem'. Many school systems, regional education agencies and institutions of higher education have designed alternative programs to meet their local needs. But InTech remains the best known, most widespread and well-developed technology training model in the state.

InTech is not a static program; it is currently being extended in content and to serve additional populations. InTech has integrated experiences with assistive technologies into the basic program. A program specifically for media specialists has been developed. Some teacher education programs have used a form of InTech to train their pre-service teachers. Higher education faculty have participated in InTech in partnerships with pre-service or in-service teachers. A program based on the model for higher education faculty is in the planning stages. A second, more advanced, level of InTech is in a pilot phase and may answer criticism that the basic InTech doesn't go far enough toward true integration of technology into teaching, learning and the curriculum.



Whether technology integration training is called InTech or not, there is a need for more of it. But such training must be based on real needs of real people. The support and incentives for participation and implementation into the curriculum must be in place. Research can provide data upon which to base these programs, and can provide rationales for continuation or expansion. Support and incentives must be provided at the state and local levels in order for individuals to really buy into the potential of technology to improve teaching and learning.

## References

- Anderson, S., & Harris, J. (1997). Factors associated with amount of use and benefits obtained by users of a statewide educational computing network. Educational Technology Research and Development, 45 (1), 19-50.
- Becker, H. J. (1999). Internet use by teachers: Conditions of professional use and teacher-directed student use. Teaching, Learning, and Computing: 1998 National Survey. Center for Research on Information Technology and Organizations, The University of California, Irvine. [Online]. Retrieved January 2001 from the World Wide Web: <http://www.crito.uci.edu/TLC/findings/Internet-Use/startpage.htm>
- Becker, H. J. (2000, April). Teacher technology leadership: Messages for teachers to tell school administrators. Paper presented at the annual meeting of the American Educational Research Association annual meeting, Montreal, Canada.
- Bennett, C. K. (1996). Schools, technology, and educational leadership: A framework for change. NASSP Bulletin, 80 (577), 63-71.
- Bernie School District (1999). Student Achievement Survey. [WWW document]. URL <http://www.bernie.k12.mo.us/survey/stuach.html>
- Cohen, J. (1988). Statistical power analysis for the behavioral sciences. New York: John Wiley.
- Holmes, E., Redish, T., Whitacre, L., Bennett, S., & Talley, V. (1998). Design Manual for Georgia Framework for Integrating Technology in the Student-Centered Classroom. Atlanta, Georgia: Georgia Department of Education.
- Feng, Y. (1995). Some thoughts about applying constructivist theories of learning to guide instruction. University of Washington [Online]. Retrieved April 2001 from the World Wide Web: [http://www.coe.uh.edu/insite/elec\\_pub/html1995/196.htm](http://www.coe.uh.edu/insite/elec_pub/html1995/196.htm)
- Gay, L. R. & Airasian, P. (2000). Educational research: Competencies for analysis and application (6<sup>th</sup> ed.). Upper Saddle River, NJ: Prentice Hall.
- Jonassen, D., Carr, C., & Hsui-Ping, Y. (1998). Computers as MindTools for engaging learners in critical thinking. Techtrends, 43(2), 24-32.
- Lambert, L. (1998). Building leadership capacity in schools. Alexandria, VA: Association for Supervision and Curriculum Development.
- National Council for Accreditation of Teacher Education [NCATE] Task Force on Professional Development. (1997). Technology and the new professional teacher: Preparing for the 21st Century Classroom. [Online]. Retrieved April 2001 from the World Wide Web: <http://www.ncate.org/accred/projects/tech/tech-21.htm>
- Onwuegbuzie, A.J., & Teddlie, C. (in press). Advanced data analysis techniques in mixed method research. In A. Tashakkori & C. Teddlie (Eds.) Handbook of mixed methods in social behavioral research. Thousand Oaks, CA: SAGE.
- Saye, J. W. (1998). Technology in the classroom: The role of dispositions in teacher gate keeping. Journal of Curriculum and Supervision, 13, (3), 210-235.
- Stanley, R. B., Lindauer, P., & Petrie, G. (1998, Summer). Factors that increase teachers' use of computer technology. ERS Spectrum 42-46.
- Strommen, E. F., & Lincoln, B. (1992). Constructivism, technology, and the future of classroom learning. Education and Urban Society, 24 (4), 466-477.

# Teachers' Perceptions of Technology: Four Categories of Concerns

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## Introduction

Today, many educational institutions have been challenged to integrate technology into their work settings. Technology is a mean of supporting goals related to increased student involvement with complex, authentic tasks within classrooms and schools (Scheingold, 1991). However, successful technology integrations are sometimes confronted with several difficulties, which include clients' resistance to change (Conner, 1992; Collins, 1991) or the lack of cooperation of the part of the people involved in that change (Kemp, 1996).

Recently, researchers argue that an innovation without considering clients' needs or concerns usually resulted in resistance to change (Ertmer, 1996; Hall & Hord, 1978; Dormant, 1986). The reason for this problem is a lack of attention to the clients' attitude, perceptions, and concerns that people form toward innovation. These concerns play an important role in the innovation process as well as in the inherent quality of the proposed change (Pershing, An, & Lee, 2000). Hence, identifying and addressing concerns and perceptions are an essential task of change agents during the whole innovation process. In this article, I will introduce a framework for analyzing clients' concerns and perceptions based on an information technology project that has been implemented in a seminary setting during the last five years. While conducting interviews with the teaching faculty members who participated in the information technology project at a seminary, I identified four categories of concerns. In this article, I will explain the characteristics of and interventions in each category of concern.

## Context of the Case

In the mid 1990s a seminary in the Midwestern United States was awarded an externally funded grant for a technology initiative, which included developing instructional computing capabilities throughout the school (Saint Meinrad, 1995). The seminary hired two instructional interns to provide computer training to the seminary faculty and staff. At the beginning phase of the initiative, the interns conducted a training needs analysis. The main focus of the analysis was to gather information about the kinds of training programs faculty and staff members would need. Through the analysis, however, several concerns surfaced (Saint Meinrad, 1998). For example, the faculty members did not seem to think that computer technology was a tool useful for theology education, which emphasizes personal interactions within small groups. Administrators of the initiative, however, did not pay much attention to this perceived concern. They proceeded on the assumption that faculty members always complain about new initiatives, and they viewed such concerns as natural. They assumed that faculty members would eventually accept and use computers provided the faculty members received the proper training. With these assumptions in place, the administrators put effort into collecting and addressing training needs information while ignoring their concerns.

After the interns had provided in-service training for one year, they began to make informal visits to the classrooms, computer labs, library, and the faculty resource center. They found that many faculty members were not integrating computers into their teaching. According to the project implementation plan, almost all faculty members should have been using computers in their instruction after one year, since all the necessary facilities and training had been provided.

Faced with such resistance, the administration began to take the idea of concerns seriously. The administrators of the seminary learned it was not the lack of facilities or training, but concerns of the faculty that affected the success of the initiative. With this realization, they asked the interns to conduct a concerns analysis. One-on-one interviews and document analyses were used as data collection methods. All twenty-six teaching faculty and several administrators and staff of the seminary were interviewed (Lee, 2001). After conducting many rounds of card sorting, the interns identified four categories of concerns as below.

## Category I: Concerns of Individual Incompatibility

Faculty perceived that the project was not compatible with their theological values or past personal experiences. These concerns had a critical influence in the earlier stages. Some faculty who understood and were well informed about the project, however, had not embrace it because of their perception of technology as opposing theological pedagogy. If they were not persuaded during the earlier stages, then it was hard to accept the project. Hence, this area of concern was critically important in the earlier stages of an innovation project, but its importance declined in the following stages. The following are several representatives of this area of concerns.

## **Conflicts of Needs between Institution and Faculty Regarding Technology**

A definite incongruence existed in needs between individual faculty and the seminary as a whole. The institution had emphasized that technology was the only tool to increase learning effectiveness in the information age. However, to the individual faculty, using technology was just one of many ways to improve learning methodologies. As one faculty pointed out, to accomplish the goal, it was not necessary to incorporate technology, because technology was not the only way to accomplish the goals. Furthermore, overemphasis on technology at the beginning stage of the project negatively influenced all faculty members.

## **Skepticism about Technology**

Ten faculty members among the 26 were very skeptical about technology. This resulted from their not being aware of the worth, potential benefits, or value of technology. Also, they were not convinced that technology was indispensable for their academic setting or their personal lives.

## **Paradigm Paralysis**

Fourteen faculty members out of 26 expressed this category of concern, which was the largest barrier to adopting technology among the faculty members of the seminary. This concern can be broken down into two sub-categories: the faculty's perception of technology as opposing theological pedagogy, and the faculty's comfort with current teaching styles. Faculty members thought that technology (or the information technology project) was basically incompatible with their theological context.

Theology, they argued, should focus on nurturing human nature, which is only possible with human interactions between instructors and students. In this point, they felt that their particular theological discipline could not adapt itself to technology because theological educators are suspect of the value of technology beyond the basics of classroom pedagogy. The other reason is that they believed their current teaching style had worked well for several decades, so there was little desire to take the time to change it.

## **Fear of Technology**

Nine faculty members expressed fear of technology in two forms: fear of the unknown and fear of the new. Some faculty were afraid something would go wrong with the computers. Most faculty said that they had not grown up in the technology culture. To them, technology was a foreign area. Even adopters of the innovation expressed concerns that technology had advanced so drastically that keeping pace with the advancement of technology seemed impossible.

## **Laggard Syndrome**

Nine faculty members perceived themselves as being far behind in using technology. One faculty who used technology in his classroom setting even expressed that he was at the knowledge stage, still trying to find out the benefits of technology.

## **False Information/ Irrational Belief**

Seven faculty members sympathized strongly with the criticism that technology is not a learning tool proper for the seminary. Some faculty mentioned that technology is a deterrent to human learning and communication. Those arguments were not based on scientifically proven facts but were based on personal feelings or subjective reflections. However, these feelings have not allowed them to see the potential benefits of the technology.

What effective interventions should be needed to address this category of concerns? Rogers (1995) indicated that person-to-person communication is important to address this area of concerns. Dormant (1986) also suggested that change agents should be counselors who draw out concerns, and listen to and clarify the adoption units' needs and interests. Hence, individual persuasion is a useful strategy to address this area of concerns by providing counseling and consultation sessions. The seminary realized that persuasion on an individual basis was the best strategy after noticing faculty's resistance to the innovation.

The seminary recognized that a core group was very skeptical about technology even after several years had passed since the innovation started. To identify their concerns, the seminary conducted one-on-one interviews with faculty members to become aware of the many issues that related to this area. The seminary stressed that Instructional Service staff were not attempting to change faculty's teaching styles, but to enhance their teaching styles with the use of technology. Also, the seminary published a monthly technology newsletter, both in print and on the intranet, featuring articles on the individual-incompatible area of concerns. Several faculty members wrote articles mentioning their successful experiences with technology in their teaching settings. The seminary provided opportunities for faculty members to visit other advanced technology-driven education institutes or learning opportunities to familiarize them with the practical applicability of technology in the seminary context. Also, more than ten faculty members attended technology-related seminars, conferences, and workshops.

## **Category II: Concerns of Unknown**

Even when the value of an innovation is compatible with the target audience's values, the individuals of the adoption units may not accept the proposed innovation as planned for several reasons, including fear of the unknown and lack of information or knowledge required to implement the innovation. In the earlier stages, the individual faculty usually felt fear of the unknown or fear of lacking required knowledge or skills. The following are the typical examples of this category of concern.

### **More Work**

To eight faculty members, technology was one more burden that they had to learn. Technology adds or creates another task. Even faculty who used technology in the classroom expressed this concern most often. To learn technology was becoming increasingly stressful and time consuming for the faculty members.

### **Lack of Detailed Information about the Project**

The vision of the project was not address well to all faculty members. The lack of vision also made it difficult to set up the details for diffusing the innovation. Five faculty confessed that they were not aware of the detailed tasks in relation to the innovation. They expressed concerns about how technological innovations were to apply to the particular learning environment.

### **Teaching/Mentoring Concerns**

Providing individual teaching or mentoring was an effective means of adopting the technology by faculty members. Individual training was preferred over group sessions by the school faculty. Several reasons were expressed. The difficulty of finding a common time among faculty members and consideration of individual pacing were major reasons.

### **Time Conflict**

Eight faculty mentioned that time was one of the most important concerns in their not adopting technology. They said that technology was not a priority to them, for their primary responsibility was to prepare a class or preach. Some faculty had not even tried to learn technology because they worried about how much time would be spent.

### **Students' Unfavorable Attitudes toward Technology**

Students' unfavorable attitudes toward technology were also mentioned by two faculty members. Ironically, faculty members who had unfavorable attitudes toward technology mentioned that students showed the same phenomena. Two faculty expressed that students did not say that the technology helped them. That made some faculty not use much technology in classrooms.

### **Lack of Information about Good Applications**

Four faculty members said that it was hard to find someone who had applied technology very well. There was no easy way to identify other faculty members on campus who had already begun to use technology effectively in their teaching. And for most theological disciplines in particular, there was no comprehensive, easy-to-find source of information about relevant instructional applications of technology. While the number of locally successful models of educational uses of technology continued to increase, access to good descriptions of those models, training for them, and reports of their strengths and weaknesses were not easy to find.

The major strategy for addressing this category of concerns is learning, because usually these concerns can be overcome by providing well-organized training programs, job aids, and consultation programs. Also, providing correct information in a timely manner is another useful strategy to address this area of concern. However, the faculty's learning focus changed from general and basic issues of technology to more elaborate and complicated issues, such as transferring or applying the technology in more specific contexts in this case. This is why the learning format changed over time from the general group-based to the individual customized format.

To identify issues in this area and set up learning interventions, the seminary conducted a needs analysis project by conducting interviews with each faculty member as well as mailed surveys (Saint Meinrad, 1998). Based on these phenomena, several learning interventions were arranged in the seminary. First of all, an individual learning road map for each faculty member was developed. According to the road map, the well-organized technology training programs were provided for the following year. The interns had been working on-site on a weekly basis. After taking these programs for one year, the faculty improved their computer competencies from 2.5 out of 5 on the Likert scale to 3.1 in the same survey (Saint Meinrad, 1998). As the faculty moved deeper into the innovation, the focus of learning shifted to more individualized consulting and one-to-one training sessions. Also, remote consulting was offered by using electronic communication channels between the faculty and the outside interns.

To address time concerns, the seminary formed a committee to reorganize teaching loads. The recommendation of the committee was that the eclectic courses could be cancelled if few students enrolled, so the faculty could be learning at that time instead of teaching the course. Also, lack of time to learn was the most crucial factor in this category of concerns in this seminary. To address this concern, the seminary developed a training schedule that was flexible, meeting at different hours of the day, even evenings, so that the faculty could best take advantage of the offerings.

### **Category III: Concerns of Organizational Support**

The organizational-compatible concerns were salient factors to be considered at the middle stage of the project at the seminary. Faculty who understood the benefits of the innovation did not adopt it because there were no organizational encouragements to do so. Many faculty members expressed concerns about the lack of organizational supporting systems and motivational systems. The following remarks are the typical expressions of this category of concern. The following are several representative examples of this category of concern.

#### **Equipment and Maintenance Problems**

Several concerns were expressed in this category by seven faculty members. First, the faculty experienced difficulties when servers went down, especially after hours or on weekends. Some buildings were not equipped with technology. Not much software was installed in the Faculty Resource Center (FRC) or the Educational Technology Center (ETC), which made programs hard to access when needed. Services from maintenance persons were hard to find or untimely when computing problems occurred. Students may not have had support from the seminary to fix their computers if the computers had problems.

#### **Students' Limited Access to Equipment and Support Services**

Three faculty members of the 26 mentioned that students' opportunities to access technology were limited. Not all the students' rooms and classrooms were wired. Some students could not access the technology, so electronic communication was sometimes impossible. Also, the computers in the student production center were so old that students could not use advanced software.

#### **Students not Involved**

Three faculty members mentioned that students were not involved in the innovation from the start. It was directed to the faculty group only and it began without asking how students would learn or use the technology.

### **Lack of Organizational Benefits**

Lack of organizational benefits and motivational factors were mentioned by seven faculty members out of 26. The institution did not recognize the adopters of the innovation. Two faculty mentioned they might have adopted it if the institution had offered some motivation or incentives, such as monetary benefits. Suggestions of non-monetary benefits were also mentioned, such as vacations and training opportunities, and to lessen the teaching burden.

### **Distrust and Poor Communication Among Stakeholders**

There was little communication and coordination among stakeholders during the innovation diffusion process. The innovation initiators did not even try to gather ideas from the three constituent groups, faculty members, staff, and students, in order to make the most effective uses of technology, new approaches to teaching and learning, and other available resources in the seminary setting. Six faculty of the 26 expressed problems with innovation in this category.

This area of concerns is relatively easy to measure and to eliminate if addressed carefully and in a timely fashion during the innovation diffusion process (Fisher, Wilmore, & Howell, 1994). Traditionally, most change scholars have overlooked these concerns at the beginning. However, in order to lead a successful innovation project, the plan has to be reviewed regularly during the innovation process. Raising money, allocating resources, and providing technical and administrative support, including incentives or motivational systems, are essential elements.

These concerns can be eliminated by acquiring resources and equipment, providing timely technical and administrative support, providing incentives or benefit systems, and maintaining equipment. Foa (1993) pointed out that incentives, support, and reward structures are needed in order to make the efforts of the individuals more widespread and their results used more comprehensively. Major problems for the seminary lay in the institution's failure to provide motivation or incentives to encourage faculty members' active usage of the innovation. Many faculty suggested both monetary and non-monetary benefits and motivators, such as vacations, training opportunities, and a lessened teaching burden. While not providing any monetary benefits, the seminary provided many forms of non-monetary benefits, such as providing training programs and visiting other technologically advanced schools. The director of the Academic Computing Department became a member of the president's cabinet, a group of advisors to the president, and thus was directly involved in developing a new master plan, which included major renovations of several buildings over the next five years.

### **Category IV: Concerns of Organizational Incompatibility**

Last category of concerns is related to the organizational incompatibility. Faculty expressed that the innovation was not compatible with the seminary culture. The seminary culture was oriented toward more human interaction, and focused on formation-building. Furthermore, the seminary was isolated geographically, as well as divided by disciplines. They also expressed their isolation regarding the innovation. The innovation was initiated in a top-down manner. They did not receive information in a timely fashion. Clear goals and directions for the innovation were not given to the faculty. Furthermore, faculty tended to work individually rather than in teams. Every faculty member understood the innovation differently. Hence, they perceived that two incongruent innovation diffusion tracks existed in the seminary: the individual faculty track and that of the institution. This concern began to increase in importance after addressing the individual-incompatible concerns, but increased strongly in importance at the implementation stage during the diffusion process. The following are several examples of this category of concerns.

#### **Isolated Culture**

The cultural characteristics of the seminary, 4 faculty argued, were not compatible with technology. First, in preparing people for the ministry, the top priority of the seminary is fundamentally different than preparing people to teach in other higher educational institutions. The use of technology can be maximized mainly in the latter setting. Religious organizations such as the seminary must emphasize the value of forming and building relationships, which does not embrace technology. Hence, some faculty mentioned that technology was not a driving force at the seminary. Second, faculty had not grown up in a technology culture. Some faculty mentioned that the European learning model, which mainly uses lecture format in classrooms, had influenced the faculty members who had studied in Europe, who were the majority in the seminary. Third, the individuality of faculty members was

another cultural characteristic. Most of the faculty pursued different disciplines and different areas of interest. That was the major reason why faculty were accustomed to working individually rather than in teams, which the innovation sometimes required them to do.

### **Class Characteristics**

Another reason for incompatibility originated from the class contexts that were small-group class setting and technology was not related the course content. Five faculty members argued that technology could not make an impact in a small class. Most of classes were populated by fewer than 10 students. In this situation, technology was ineffective for increasing learning. The other reason why the faculty did not utilize technology during class was their perception of the inability of the course to embrace technology.

### **Sharing and Showing**

Learning technology was one of the biggest concerns of the faculty members. Nine faculty members of the 26 expressed this type of concern. Sharing information about, or experiences with, technology among faculty was vital, and it could have been a strong influence on the faculty as a whole. Partly owing to a lack of vision for the innovation and to a lack of concrete examples of how to apply technology in a seminary setting, the faculty wanted to see other people's experiences and or knowledge.

### **Not Having a Clear Image of the Project**

Eleven faculty out of 26 expressed a lack of vision for the project from the beginning. This area of concern was the second largest barrier for the faculty. They argued that the innovation project was started by grant money rather than a vision. Without serious questions about why this innovation was needed in the seminary, the institution started the innovation, and this made it difficult for the faculty members to grasp the vision or purpose of the innovation.

### **Fragmented Technology Planning**

Five faculty members argued that the innovation was started without considering the necessity of information technology carefully in the context of Catholic pedagogy. They expressed that the innovation was focused on teaching rather than learning, and focused on media rather than methods. Two faculty criticized the innovation for starting in reverse order, selecting media (buying computers) without considering methods. One faculty mentioned that this project had missed one critical stage in the beginning: needs assessment or values clarification.

Collaboration was the most useful strategy to address this area of concern in the seminary. To address issues of this area, the seminary's geographical isolation, diverse faculty disciplines, and a top-down diffusion strategy, collaborative work among the faculty was essential. For example, creating a vision statement and sharing the innovation-related experiences with other individuals in the adoption units were helpful tasks in the seminary.

The seminary formed an ad hoc committee to set up a clear vision for technology and teaching at the seminary. The committee developed a vision with consensus from all faculty members and reported their findings to the faculty. Another intervention was to arrange several learning events in order to facilitate collaborative work among faculty members in the seminary. Through these events, faculty members shared their ideas with other faculty members. Sharing among faculty was the key activity for changing the seminary culture. These events included faculty presentation day, faculty learning day, small group interests, brownbag lunches and learning sessions. Also, through the funds from the grant, many faculty took advantage of conference opportunities to gain more knowledge about the appropriate use of technology. Furthermore, the seminary developed contacts with other schools facing the same issues and was able to find and demonstrate good practices in technology for theological instruction.

### **Concluding remarks**

Information technology is an effective means of increasing teaching and learning effectiveness in higher educational settings including seminaries. However, it must be well planned and organized before the project begins. Identifying clients' concerns and taking care of them are an important task of change agents during an innovation

process. Setting up a vision statement, conducting perception analysis, and preparing detailed plans for the project would guarantee a successful implementation of an information technology project in a higher education setting.

## References

- Collins, A. (1991). The role of computer technology in restructuring schools. Phi Delta Kappan, 73 (1), 28-36.
- Conner, D. R. (1992). Managing at the speed of change: How resilient managers succeed and prosper where others fail. New York: Villard Books,
- Dormant, D. (1986). The ABCDs of managing change. In Introduction to performance technology (pp.238-256). Washington, D.C.: National Society for Performance and Instruction.
- Ertmer, P. A. (1999). Addressing first and second order barriers to change: Strategies for technology integration. Educational Technology Research & Development, 47 (4), 47-61.
- Fear, Frank. (1994). Initiating, implementing, and studying large-scale university change: Outreach at Michigan State University. Paper presented at the annual conference of the Society for College and University Planning, San Francisco, CA.
- Fisher, C., Wilmore, F. & Howell, R. (1994). Classroom technology and the new pedagogy. Journal of Computing in Childhood Education, 5, 119-129.
- Foa, L.J. (1993). Technology and change: Composing a four-part harmony. Educom Review, 28(2), 27-30.
- Hall, G. E. & Hord, S. M. (1978). Change in schools: Facilitating the process. Albany: State University of New York Press.
- Kemp, J. E. (1996, January/February). School restructuring: Your school can do it. Techtrends, 41(1), 12-15.
- Lee, H. (2001). Comprehensive innovation diffusion model in a higher educational setting: Post-facto formative research. Unpublished Ph.D. dissertation. Indiana University.
- Pershing, J.A., An, J., & Lee, H. (2000). Why do well-planned performance improvement innovations fail? The importance of perception analysis. Paper presented at the International Society for Performance Improvement Culture & Change Management Conference, Washington D.C.
- Rogers, E.M. (1995). Diffusion of innovations (4th ed.). New York: Free Press
- Saint Meinrad School of Theology (1995). Proposal for a campus network and technology empowerment project. Unpublished manuscript. Saint Meinrad School of Theology, St. Meinrad, IN.
- Saint Meinrad School of Theology. (1998). Integrating technology in instruction: Needs analysis project at Saint Meinrad School of Theology. Unpublished manuscript. Saint Meinrad School of Theology, St. Meinrad.
- Saint Meinrad School of Theology (2000). Mission and goal statements for the innovation. Unpublished raw data.
- Sheingold, K. (1991). Restructuring for learning with technology: The potential for synergy. Phi Delta Kappan, 73 (1), 17-27.



# Developing a Scaffolding System to Support Mathematical Investigations

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## Abstract

*This paper looks at the analysis leading to and design of a Web-based “hint system.” The hints are designed to help middle-grades teachers participating in a mathematics professional development effort called InterMath achieve a high degree of success when working open-ended mathematical investigations. We discuss the issues and processes involved with designing this system, paying special attention to the different types of hints and the limitations of the system.*

## Background

InterMath (<http://www.intermath-uga.gatech.edu>) is a web-based, technology-intensive professional development experience for middle school mathematics teachers. The professional development effort is aimed at furthering teachers’ mathematics knowledge, providing experience with using a variety of tools to promote learning, and supporting meaningful technology integration for middle school mathematics classrooms. The model upon which InterMath is based assumes that teachers who experience learning in a rich, exploration-based environment will more readily transfer these kinds of experiences to their classrooms. The centerpiece of the InterMath experience and website is an extensive set of open-ended mathematical investigations that can be explored using various technologies (e.g., Excel or Geometer’s Sketchpad). These investigations form the central experience of the fifteen-week workshop as teachers are encouraged to explore a particular set of explorations (e.g., triangles or functions), choose problems that intrigue them, work those investigations, and write-up the solutions, along with extension activities.

Unlike the traditional “make and take” professional development experiences, InterMath does not aim to provide teachers with activities they can take back to their classroom and use. Instead, InterMath provides teachers with opportunities to hone their mathematics skills, reinforcing both their understanding of mathematics and their ideas about what it means to learn (and, thus, teach) mathematics.

InterMath is in its third year of development and implementation. During the pilot workshop offerings in Year 2, there were two InterMath workshops conducted by two different faculty members. One workshop was offered near Atlanta as the first course in a cohort-based graduate degree program for middle school teachers. This workshop was taught by a mathematics education professor who is also one of the developers of the InterMath program. The other workshop was offered at the University of Georgia campus by a professor of mathematics. The participants in the UGA workshop received staff development credits for their experience, as well as a stipend.

## The Problem

Our initial work with teachers indicated that one of the challenges of InterMath is that the teachers are uncomfortable engaging in problems that they do not feel confident in their ability to finish. The teachers tend to work the easier problems first – and may not ever work the problems they perceive as being the most challenging. However, those challenging problems may be the ones that provide the greatest learning experience. Our interviews with teachers and classroom interactions indicated that there were multiple reasons for these problem selection behaviors. The most troubling reason, however, was an avoidance of mathematics that was viewed as difficult.

To further complicate the situation, teachers in our pilot workshops were considerably more challenged by the variety and uses of technology required for success in the workshop than we had anticipated. We expected teachers to be able, by the end of the workshop, to use Geometer’s Sketchpad, NuCalc, and Excel, as well as to be able to create and publish a webpage using a WYSIWYG editor and FTP software. While most of the teachers had already completed a basic technology workshop series, they had little to no experience using technology to support learning in a particular content area. Further, many had little hands-on experience in using the computers with their

students to support mathematics of any kind. In short, InterMath requires teachers to be comfortable with many pieces of technology, as well as to develop a concrete image of what technology can help them accomplish in their content area.

It was determined that these problems were serious enough to warrant additional support structures being created to support teachers in successfully expanding their own content knowledge as well as their pedagogical content knowledge. To this end, it was decided that some form of online help or hint system needed to be developed for the InterMath problem set that would allow teachers to be more successful in their interactions with our materials.

This paper describes the design process to date and discusses the implications of our analysis phase on the kind of hint systems we are working on. To date, we have completed the analysis system and have implemented a rapid prototyping (Tripp & Bichelmeyer, 1990) approach to help explore the potential of each option. Further, we have completed an initial paper-based design of the “constructopedia,” a separate aspect of the InterMath scaffolding system that will be discussed later in this paper

### **An Analysis of the Problem**

The analysis portion of the hint system project occurred during Winter and Spring 2001. Data were collected in the form of conversations – both live and via email – with a variety of subject-matter experts who are participants in the InterMath project, as well as observations and informal interviews of teachers involved in the pilot workshop. The discussions among team members were a rich source of data for thinking about what we value in the learning process and what matters in how we interact with the learners.

### **Learner Analysis**

Information was collected during each InterMath session through both formal and informal means. InterMath instructors and facilitators informally observed activities and comments while teaching and while circulating to check on participants' progress and to provide them with technological and mathematical assistance when needed. Formally, at least one person was designated as the class observer each session and took detailed notes regarding events that occurred in class, including participants' actions, comments, technical problems, successes, and mathematical difficulties. In addition, many participants were interviewed at the conclusion of the workshops. The informal and formal observations, along with transcripts of the interviews, provided a wealth of information regarding the difficulties the workshop participants had experienced and how the InterMath experience could be changed to better benefit teachers in future InterMath workshops.

As anticipated, an analysis of the data provided much insight into the InterMath experience from the perspective of the teachers enrolled in the class. While every participant said that he or she would recommend or have already recommended InterMath to other teachers, their comments provided valuable information about problems they experienced during the course. Some teachers noted how time-consuming problems can be and how many problems on the InterMath website cannot be used with their classes without modifications. However, two other issues were mentioned repeatedly as the predominate difficulties teachers faced in the workshop – difficulties with the technologies being used and problems with the mathematics itself. This paper addresses the second of these two issues.

A number of the participants expressed frustration over the difficulty of many InterMath problem sets. Some of the participants noted that they do not have strong backgrounds in mathematics, while others described the mathematical rustiness that has occurred while teaching middle grades math.

*“There's some of the math that, right now, I don't think I have down pat.”*

*“I don't have a very strong math background, so I struggle with a lot of the problems.... I mean it's been a long time since I've been in a math class. I know this is a graduate class, but I've only been teaching 7<sup>th</sup> grade math and there's only so much that we do – so the vocabulary and all is unfamiliar to me.”*

*“A few of them it's going to take some brushing up on – because as a 7<sup>th</sup> grade teacher, there are a few things that we don't hit in 7<sup>th</sup> grade.”*

*“That's the hardest part. Sort of bringing out the true math that's behind it. Because I don't know if I know enough to do it.”*

Many participants noted in their interviews how helpful the assistance from course facilitators was when technological or mathematical impasses were experienced.

*“Brian and Shannon have been wonderful. They've talked me through so many [problems].”*

*“I think the very best part is probably the instructors – the people that are helping out.... Because they're so understanding and they don't act like you're stupid when you don't know how to do something.”*

These comments alone give sufficient cause to consider creating some type of mathematical scaffolding system for the InterMath workshop. InterMath personnel are not always on hand when the teachers are working on their problem sets.

In describing how their ideal math classrooms would operate and how they believe students learn, some teachers revealed the importance they place on scaffolding their own students, further prompting InterMath designers to consider the implementation of a hint system.

*“I can steer them and give them hints. And it also helps if they're going in a completely wrong direction. I can hear that too and steer them the right way.”*

*“I teach 6<sup>th</sup> grade – so some are way over their heads and some are more appropriate. So I kind of have to give them a little bit of guidance and they know what they're looking for. If you just let them go blindly, then they're gonna, they're gonna get lost.”*

Based on the information gathered throughout the course of the InterMath workshop and post-workshop interviews with the participants, it seemed obvious that a hint system would be a beneficial addition to this professional development endeavor. The goals of this system would be to encourage teachers to select problems that are more difficult than those they might otherwise attempt, assist them in furthering their mathematical thinking and understanding, and decrease the frustration that can occur when they come to a point where no more progress can be made without some type of assistance.

## **Hint System**

Because the teachers needed more support than could be offered in the workshop and because our team could not be available all the time, we decided that an online system to support teacher learning anytime, anywhere was a critical element of the support system. To this end, we determined that developing some form of scaffolding system would be appropriate. By adding a “hint” to the more complicated problems, we may be able to aid teachers in persevering to become more successful problem-solvers. These hints may focus on the mathematics or on the use of technology to support the mathematics. We are striving to balance between providing too little and too much support to the teachers.

One of our primary concerns in considering this support system has been that it may inadvertently limit the cognitive growth potential for users of InterMath. Based on our initial field test of the hints, this concern is well-founded. Teachers in our test group clicked on the hint before they attempted to solve the problem on their own. The static hint system cannot provide the cooperative problem-solving effort between the learner and a more knowledgeable other that defines scaffolding (Collins, Brown, & Newman, 1989), nor can it anticipate exactly when the learner may require assistance. Learning in this environment comes from engagement in the problem-solving process, therefore the learners need to be actively involved in the process in order to benefit. If they click on the hint before struggling on their own, the potential of the learning experience may be significantly weakened. Further, the hint system needed to push thinking forward and promote metacognitive engagement rather than provide a crutch that eases the cognitive involvement of the learners and results in over-reliance in the system over time (Kao & Lehman, 1997).

Another issue that arose in the analysis phase was the purpose of the hints. We identified three distinctly different purposes hints might serve. The team also explored some of the arguments against developing an online scaffolding system. Because of these concerns, we were working toward developing a system that attempted to use only questions or tools that the learners will be able to use on other problems and in other ways (Polya, 1981). In this way, we aimed to develop a tool that, while static, might support the development of transferable knowledge for the learner.

## No Hints

The arguments against the hint system arose from our beliefs about learning and our previous work with teachers supporting students in computer-based environments (e.g., Hawley & Duffy, 1998). In addition to the concern that the hint system might become a crutch, we were further concerned about the ability of an online scaffolding system to provide the kind of help the learner needed at the time he needed it – his zone of proximal development (ZPD) (Vygotsky, 1978). After all, the online system cannot sense where the learner is within a problem, what the learner’s mathematical knowledge is, or whether the problem is a technical one (e.g., not knowing how to construct a shape or write a formula) or a mathematical one (e.g., not knowing how to approach a problem). It was the “inside help” that we felt the system could not provide (Polya, 1981). That is, the computer is not sensitive or “intelligent” enough to provide the learner with the kinds of questions or suggestions that may have occurred to the student – and those are the questions that move the student to new levels. This kind of help assumes that there are some general ideas that can guide the learner from one problem to another. This is in sharp contrast to “outside help” which should be treated as a last resort (Polya, 1981).

Additionally, the use of a static hints system in an online setting requires the student to be responsible for “fading” the scaffolding. It is unclear that learners can effectively self-monitor to determine where they are in their own ZPD. It is clear, however, that fading is a critical part of the scaffolding process (Kao & Lehman, 1997; Oliver & Hannafin, 2000). Therefore, finding ways to provide support without over-supporting became a theme in our development process.

Finally, the static hints system is problematic in that scaffolding is often considered an interactional approach (Dris coll, 1994). It, ideally, provides for an interaction between two people that can evolve and/or fade over time. The reciprocal teaching research (e.g., Palincsar & Brown, 1984; Brown & Palincsar, 1982) provides a compelling description of a scaffolding system that exemplifies this approach. Our design team considered how or if the hint system could serve as a scaffolding device without this kind of teacher-learner interaction.

While compelling, the arguments against the hints system did not provide alternatives for supporting teachers in attempting or completing the problems that offered the most promise for their mathematical development – the “hard” math problems. Using Bruner’s view of scaffolding, we wanted to protect our learners from frustration (Bruner, 1981). Therefore, three different approaches and views of the content-oriented hints were considered: hints that aimed to keep the teachers motivated, hints that aimed to provide generalizable strategies for the learners, and hints that modeled expert thinking for the teachers. The first kind of hint sought to provide scaffolding that supported the teachers through the rough spots and helped them feel successful. The second and third kinds of hints served the purpose of trying to help the teachers become more expert-like in their approaches to mathematical problem solving.

## Motivational Hints

Occasionally teachers in the InterMath course became frustrated after working on a problem for an extended period of time without making any headway. Sometimes the teachers would give up on problems such as these and move on to less challenging ones. As InterMath is a professional development environment, one in which teachers are encouraged and expected to develop and expand their mathematical understanding, this “avoidance behavior” played a large role in our decision to develop the hint system. We believed that such a system would motivate the teachers to choose and persevere with more challenging problem sets.

In describing general principles for motivating people, Ford (1992) describes the importance of providing indirect facilitation for goal attainment, rather than controlling learners’ actions. In our case, the hint system would be that facilitation, which, for some teachers, would be the determining factor for whether they would choose a more challenging problem over a simpler one. This is particularly relevant because problems are not *assigned* to teachers in the InterMath course; teachers *choose* which problems they wish to explore, giving them more ownership of the process.

Along with the notion of learner control comes the idea of self-efficacy, or learners’ judgments about whether or not they can succeed at specified tasks (e.g., Bandura, 1989; Pajares, 1996). It was our hope that providing a hint system as scaffolding would increase learner’s feelings of self-efficacy, increasing their likelihood of choosing more complex problems and expanding their mathematical horizons.

Self-efficacy is closely tied to the concept of personal agency beliefs (Ford, 1992). Ford describes these beliefs as the evaluative thoughts comparing a desired outcome (successful completion of a problem) to an anticipated outcome (successfully and easily completing a simple problem, or possibly failing to correctly complete

a more difficult one). Ford believes that in addition to *being able to* achieve goals, learners need to *believe* in their abilities to achieve them.

*Personal agency beliefs are often more fundamental than the actual skills and circumstances they represent in the sense that they can motivate people to create opportunities and acquire capabilities they do not yet possess.* (page 251)

We hoped that providing the hint system as scaffolding would increase learners' estimations of their own abilities to solve difficult mathematics problems, improve their success rate when they do choose these problems, and provide a "safety net" in case they do become stuck on the problems. We believe that a motivation-guided scaffolding system will ultimately help teachers to achieve the ultimate goal of InterMath – improving their understanding of mathematics.

Table 1: Motivational Hints for “Penning for Pony” Problem

<p><b>Problem:</b> To make a pen for his new pony, Ted will use an existing fence as one side of the pen. If he has ninety-six meters of fencing, what are the dimensions of the largest rectangular pen he can make? (Source: Mathematics Teaching in the Middle School, Nov-Dec1994).</p>
<p><b>Hint 1:</b> Is it possible to relate the amount of fencing in terms of the side length of one side of fence?</p>
<p><b>Hint 2:</b> What equations can be written to relate the side lengths created by the fencing?</p>

### Generalizable Hints

Because of our team discussions, we decided to explore multiple forms of hints for this system. To this end, Polya (1957) provided the basis for our thinking in the development of the second kind of hints – those that support the development of transferable, generalizable problem-solving strategies. Polya identified a four-step problem-solving process that includes a number of substeps. The four key steps are: (1) Understand the problem; (2) Devise a plan; (3) Carry out the plan; and (4) Look back. In reviewing the process and reflecting on the kinds of challenges the teachers we had worked with thus far faced, we determined that providing hints that helped the learners work in phases one and two of Polya’s work would be most beneficial. To this end, a set of hints that provided both the strategy (e.g., “Can you restate the problem?”) and a specific hint for the problem of interest (e.g., “Before you answer the given problem, think about the definitions and formulas of circumference and area. On what part of each circle do you really need to focus? How do these parts relate to each other?”). The goal was to support the learner through a combination of macro- and micro-level scaffolding (Guzdial, 1994).

The goal of transfer in this static environment is a difficult one to achieve. Research has indicated that the greatest opportunity for transfer involves an active system in which the hints become more specific as needed (e.g., Bransford, Brown, & Cocking, 1999; Campione & Brown, 1987). This graduated prompting provides a way to more actively engage the learner as a partner in the scaffolding system. Due to the limitations of a static hints system, we could not offer the progressive drilling into an area that a teacher could, though we did explore that option. Instead, we chose to provide a set of hints rather than one that provided the learner with both the general hint and the specific. Our intention would be for the learner to be self-regulating in choosing to use both the hints system itself and the specific hint.

Table 2: Generalizable Hints for “Penning for Pony” Problem

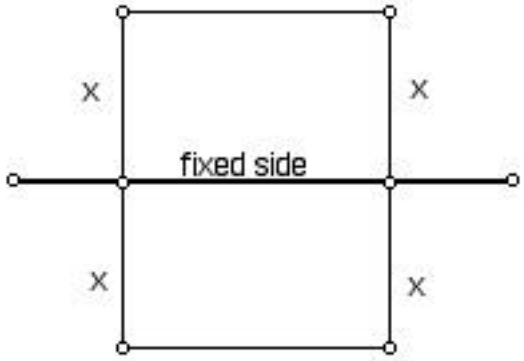
<p><b>Problem:</b> To make a pen for his new pony, Ted will use an existing fence as one side of the pen. If he has ninety-six meters of fencing, what are the dimensions of the largest rectangular pen he can make? (Source: Mathematics Teaching in the Middle School, Nov-Dec1994).</p>
<p><b>Strategy 1:</b> What are the data? What is the condition?</p>
<p><b>Hint 1:</b> What does the ninety-six meters of fence tell you about the rectangular pen?</p>
<p><b>Strategy 2:</b> Go back to the definitions.</p>
<p><b>Hint 2:</b> How do you find the area of a rectangle? How do you find the perimeter of a rectangle? How are the area and perimeter of a given rectangle related to each other?</p>

## Model Hints

Wood, Bruner, and Ross (1976) define the expert's role in scaffolding as directing and maintaining the learner's attention, while also modeling the task and highlighting the critical features of that task. Our third approach to hints builds from that notion. It is well-documented that there are fundamental differences in the way experts organize knowledge and the way novices organize that same knowledge (e.g., Bransford, Brown & Cocking, 1999). Experts tend to organize thinking and strategies around core concepts whereas, more novice thinkers tend to exhibit signs of more linear and procedural understandings. Further, experts are better able to identify appropriate instances for applying theories and procedures to problem-solving instances. Therefore, if the scaffolding system were to promote the development of more expert thinking about mathematics, one possible approach might be to provide a rich set of problems for the learners to solve and provide models of expert approaches to solving those problems.

Modeling has been shown to be an effective means for supporting learning (e.g., Palincsar & Brown, 1984; Schoenfeld, 1991). It provides an example for learners to take and adapt for their own purposes. The limitation of the modeling method is that it, too, relies on learner self-regulation. If the learner does not engage in reflective adoption and adaptation of the modeled example, that learner has learned only a prescriptive task rather than a generalizable approach. With a hint system of this kind, our goal would be to support the learner to reflect on what was important in a situation. The instructor may need to spend time engaging learners in reflective activities to gain the skill necessary to do this. However, this may be a powerful way to help move middle grades teachers, notoriously underprepared in their content areas (e.g., SREB, 1998), toward developing more expert levels of content understanding.

**Table 3: Model Hints for “Penning for Pony” Problem**

<p><b>Problem:</b> To make a pen for his new pony, Ted will use an existing fence as one side of the pen. If he has ninety-six meters of fencing, what are the dimensions of the largest rectangular pen he can make? (Source: Mathematics Teaching in the Middle School, Nov-Dec 1994).</p>
<p><b>Hint 1:</b> What if we built a similar figure on each side of the fixed wall?</p>  <p>The diagram shows a rectangle with one horizontal side at the bottom. This side is part of a longer horizontal line representing a wall, with the text "fixed side" written above it. The other three sides of the rectangle (top, left, and right) are each labeled with an "x". Small circles are placed at the four corners of the rectangle.</p>
<p><b>Hint 2:</b> Use the algebraic mean – geometric mean inequality to find the greatest possible area, then use that information to determine the length of each side.</p> <p>(Hint 2 also includes working of the mathematical equations.)</p>

## **The Design Process**

Our design process ran parallel to our evaluation process. We began by looking at existing systems to see how they provided support for learners. These systems included the support system in the Knowledge Integration Environment (KIE) (Slotta & Linn, 2000), as well as EMILE (Guzdial, 1994) and CSILE (Scardamalia et al., 1992). These tools provided very different approaches to scaffolding learning, ranging from static to very dynamic and including various levels of teacher/knowledgeable other support within the system.

The tools that we reviewed ranged, also, from technologically complex to those that were relatively simple. In the end, the decision to follow a simpler path was tied to two issues: budget and time. The enormous undertaking of developing a dynamic support system was outside the scope of our efforts and was not included in the budget. Further, InterMath is a multifaceted system that includes communication tools, a dictionary, materials for instructors, and, of course, the investigations. Because each of these pieces requires support, the need to keep the scaffolding system to a manageable size was considerable. Further, the InterMath team recognized that teachers in need of more specialized support could contact an InterMath team member or could use the communications tools to pose questions to other members of the community. The trade-off with this was the loss of momentum caused by the delayed communication in an asynchronous environment. However, if we paired a just-in-time scaffolding system with these other tools, we felt we could offer support for the learners that would be meaningful.

The most critical decision made as a result of our process was the decision to split the hints system into two distinct pieces. One piece would be the hints as discussed in the analysis section. The other part would be the “constructopedia,” which is a system to support teachers in completing mathematical constructions using Geometer’s Sketchpad. While making constructions in this program is still a mathematical process, it is the point where mathematical concepts intertwine with technology. The support that teachers struggling with the technology needed was not the same kind of support they needed to conceptually understand the problem. The constructopedia borrows heavily from the Lego approach to instruction – teachers are provided with pictures that show the construction being put together. They are provided with minimal text as well because our rapid prototyping process indicated that the images alone were too confusing. The goal of the constructopedia is to provide teachers with the support they need, while forcing them to remain engaged in the mathematics of the construction.

A final portion of the design phase has been the identification of which investigations need hints and what kinds of hints they might need. This process was begun by having a new graduate student whose mathematical background was similar to our target audience’s work several of the investigations to identify places where they became difficult as well as ways she was able to overcome those difficulties. This provided a beginning guide for the hints system. However, her activity on the project team and in graduate-level mathematics education courses quickly moved her beyond the mathematical content knowledge of our target audience. Therefore, further work to identify investigations in need of support will need to be done a different way.

## **The Development Process & Future Work**

The analysis and design phases employed three instructional design strategies: 1) having a person similar to our target audience work through investigations to identify potential problems and discuss how those complications affect the successful completion of the problem; 2) reviewing existing computer-based scaffolding systems to explore the characteristics and possibilities of effective systems; and 3) working with SMEs on our team to determine how to translate face-to-face questioning strategies to static online strategies. The development phase introduces a fourth key strategy – rapid prototyping.

Both the constructopedia and the hints system itself have gone through multiple iterations. During the pilot courses, we were able to bring in different kinds of hints and test them out with members of our target audience. This provided extremely valuable feedback as we were able to put the hints system to work, watch the users interact with it, and talk to them about their reactions to it. Interestingly, in the audition of the hints strategies, the participants claimed that the hints were not useful, despite having relied on them to complete their problems.

We are currently involved with the development stages. There are still obstacles to overcome, including making the final decisions about which approach to the hints system to adopt. There are very practical considerations that must be weighed in this decision. For example, we must choose a hints system that members of our team can create and refine with little SME intervention. From this perspective, the generalizable hints are a strong contender. We must also choose the system that offers the greatest level of promise and that is most consistent with our overall approach. From this perspective, the model hints are more appropriate. At this point, the motivational hints have been left behind because our initial evaluation showed that participants found them less helpful than the others.

Another critical obstacle is determining which investigations need hints and what kinds of problems teachers might have with them. This is problematic because all of our team members have either extremely high mathematical ability, or mathematical ability that is too limited. To address this problem, we have considered a number of approaches including conducting more teacher observations during our next workshop offering and using our best guesses to find problematic investigations.

## Conclusion

In short, we see the use of a web-based hints system as being a potentially valuable tool for supporting teachers in tackling complex math problems. We recognize that there are limitations with this plan, but see combining the just-in-time help of a static system with the asynchronous support of a wider community as a viable option for promoting the development of mathematical thinking. We are currently involved in a rapid-prototyping approach to find appropriate ways for supporting teacher development.

## Works Cited

- Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist*, 44(9), 1175-1184.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.) (1999). *How people learn*. Washington, DC: National Research Council.
- Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the craft of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453-494). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Ford, M. E. (1992). *Motivating humans: Goals, emotions, and personal agency beliefs*. Newbury Park, CA: Sage Publications.
- Guzdial, M. (1994). Software-realized scaffolding to facilitate programming for science learning. *Interactive Learning Environments*, 4(1), 1-44.
- Guzdial, M. & Kehoe, C. (1998). Apprenticeship-based learning environments: A principled approach to providing software-realized scaffolding through hypermedia." *Journal of Interactive Learning Research*, 9(3-4), 289-336.
- Hawley, C. L. & Duffy, T. M. (1998). The role of the teacher in simulation learning environments. Structured poster presented at the American Educational Research Association Annual Meeting: San Diego, CA.
- Kao, M. T. & Lehman, J. D. (1997). Scaffolding in a computer-based constructivist environment for teaching statistics to college learners. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.
- Pajares, F. (1996). Self-efficacy beliefs in achievement settings. *Review of Educational Research*, 66, 543-578.
- Palincsar, A. S. & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition & Instruction*, 1(2), 111-175.
- Polya, G. (1957). *How to solve it: A new aspect of mathematical method*. (2<sup>nd</sup> ed.) Garden City, NY: Doubleday.
- Polya, G. (1981). *Mathematical discovery: On understanding, learning, and teaching problem solving*. New York: John Wiley and Sons.
- Scardamalia, M., Bereiter, C., Brett, C., Burtis, P. J., Calhoun, C. & Smith, L. N. (1992). Educational applications of a networked communal database. *Interactive Learning Environments*, 2(1), 45-71.
- Schoenfeld, A. H. (1991). On mathematics as sense-making: An informal attack on the unfortunate divorce of formal and informal mathematics. In J. F. Voss, D. N. Perkins, & J. W. Segal (Eds.), *Informal reasoning and education*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Slotta, J. D. & Linn, M. C. (2000). The Knowledge Integration Environment: Helping students use the internet effectively. In M. J. Jacobson & R. B. Kozma (Eds.). *Innovations in science and mathematics education: Advanced designs for technologies of learning*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Southern Regional Education Board (1998). *Education's weak link: Student performance in the middle grades*. Atlanta: SREB.
- Tripp, S.D., & Bichelmeyer, B.A. (1990). Rapid prototyping: An alternative instructional design strategy. *Educational Technology Research & Development*, 38(1), 31-44.



- Vygotsky, L. S. (1978). *Mind in society: the development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology & Psychiatry & Allied Disciplines*, 17(2), 89-100.

# Activity theory framework and cognitive perspectives in designing technology-based support systems

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## Abstract

*The paper conceptually elaborates the traditional concept of expert performance by Glaser et. al, and discusses a series of attributes for supporting or nurturing an environment for expertise. Then an alternative point of view from a standpoint of activity theory (social constructive theory) will be taken to see how one (instructional designer) might support an expertise in the areas of designing technology-based performance support systems.*

## Introduction

With the increased demand and interest in electronic performance support systems (EPSS), particularly for supporting knowledge-based problem solving expertise in the information age (Gustafson, 2000; Dickelman, 2000; Kasvi & Vartiainen, 2000), instructional designers are facing a new challenge designing a system that could deliver (or transfer) needed knowledge (expertise in a particular knowledge domain) to learners/users, because we do not really know what it is that learners need to learn to become effective problems solvers within the context that learning (or performance require) occurs (Backler, 1988). The questions include “What skilled/experienced problem solvers (or expert performer) go about solving a problem (a task)?” and “What kinds of knowledge they make use of when doing so?” In short, we do not really know what expertise is required for individual learners to perform particular tasks within certain conditions, and if we do not know this then how do we design an effective system to delivery them.

However, an alternate view of cognition has been developing over the past three decades or so: expertise researches from cognition psychology. Other researches that influence instructional design are so called: situated cognition, distributed cognition, activity theory, and other dimensions relating to social-cultural perspectives have been brought into attention by socio-culture psychology. Fundamentally, these notions stress the individual minds (expertise and mental model), the environment (or authentic contexts), and the tight interrelations among them (Hung, Koh, & Chua, 2000). In this paper, the author will focus on activity theory only.

Instructional designers are designing instructional environments both to understand the improvement of performance and to further define theories applicable to the design of conditions for learning. Therefore, the objective for the EPSS designer is for more people (novices and intermediate learners) to attain competence at higher levels (expert) than ever before. Given the notion that different performance may require different support, the EPSS designer needs to understand what knowledge expertise is required, how expertise (knowledge; skills) was acquired, for different individuals and in what conditions. To reach their goal, EPSS designers began to accommodate changes in theory and practice and did so in a way that added value to the discipline. Two disciplines that increasingly influenced instructional design are researches on expertise from cognitive psychology and activity theory from socio-culture psychology.

In this paper on the literature, the author will first give an overview of EPSS then review two areas of studies related to (advanced) EPSS design. One is expertise from cognitive psychology; the other is activity theory proposed by socio-culture psychology.

## What is EPSS and why should instructional designers be interested in it?

What is an Electronic Performance Support System (EPSS)? “EPSS” is still a relatively new term in the field of corporate training and instructional design, having been first introduced by Gery in 1989. An EPSS refers to any electronic integrated system or infrastructure that can provide access to information and tools to enable individuals to achieve a high level of performance in a short amount of time and with a minimum of support from other people. According to *EPSS InfoSite*, an EPSS can also be described as any computer software program or component that improves worker performance by

1. reducing the complexity or number of steps required to perform a task,
2. providing the performance information an employee needs to perform a task, or
3. providing a decision support system that enables a worker to identify the action that is appropriate for a particular set of conditions.

Currently, corporations are benefiting from the implementation and usage of integrated electronic systems (Raybould, 1995; Kasvi, 2000; Gustafson, 2000). For example, a large corporation may combine its many electronic tools (such as databases, word processing, e-mail, and calendars) into an EPSS to facilitate ease of access and usage. By using an EPSS, information or tools are more easily accessible, thus increasing the workers' efficiency (Gery, 1991; Kavat, 1997; Raybould, 1990).

When the workplace becomes increasingly complex, quick, and accurate the speed and accuracy of information processing becomes a competitive necessity, especially in the technology-rich-rapidly changing information age. In the information age, even experts may have to struggle to maintain their level of performance (Winslow and Bramer, 1994). With advances in technology, it becomes possible to provide a variety of new forms of support to aid worker performance, promote workers' satisfaction (confidence), shorten the process of transforming a novice into an expert, and potentially reducing the amount of training they require.

The definition of EPSS varies. Among other terms used are: performance support, online performance support, performance support tool, performance support engineering, performance centered design, and Embedded Support (Gustafson, 2000). The definition of EPSS here tends to be broad and encompassing. Thus, it includes everything from the simple database that provides information to workers (for example item price and customer information) to EPSSs for the complex tasks that involve complex cognitive skills (such as air traffic control systems based on expert systems and artificial intelligence).

The elements and characters of what an EPSS constitutes also vary. Gery (1991) included four elements: an information base, advisor, tutorials, and tools to assist the user. In the past decades, EPSS design has matured; it is not limited to Gery's four elements. "Information bases may include multiple knowledge sources; advising may take on features of expert systems or artificial intelligence; tutorials may be extensive and contain contextual multimedia instruction; and the tools have become more sophisticated (Gustafson, 2000; p. 37)."

However, as an instructional designer, we have every reason to believe these trends will continue, the demand of creating/developing EPSSs will grow, and the design of EPSS will not become less complex and less challenging as the rate of change keeps accelerating.

### **What are these studies on expertise about and why should instructional designers be interested in the theory of expertise?**

"It is likely true that all humans have some form of mental model or conceptualization of the operation and function of any piece of technical equipment (Johnson, 1988)." Whether accurate or not, understanding how humans learn and process knowledge (expertise) helps instructional designers in developing effective learning/support systems. As mentioned before, EPSS designers are interested in knowing what expertise is required for individual learners to perform particular tasks within what conditions and then how do we delivery them as instructional designers. In the past few decades, cognitive psychology has been studying and developing this.

Chase and Simon (1973) and deGroot (1965) were among the first to explore the development of expertise in master chess players and they proposed an information-processing perspective (theory) as the analogy of the human processor. Since then, a great deal of research has been carried out in the area of expertise in problem-solving areas, such as chess, bridge (Charness, 1979), physics (Chi, Feltovich, & Glaser, 1981), mathematics (Schoenfield and Herrmann, 1982), and medical diagnosis (Patel & Groen, 1986). More recently, research has expanded to the instructional design field (Rowland, 1992; Perez & Emery, 1995; Perez, Johnson, & Emery, 1995; Le Maistre, 1998; Julian, Larsen, & Kinzie, 1999), the sport domain, and parallels between sport and the more traditional cognitive tasks have been evidenced. However, with the studies to date, emphasis is the relationship between expertise and human competence in general. What we learn about expert performance and its acquisition is applicable to understanding and improving competence in the skills and knowledge learned in school and in the workplace.

1. Expert behaviors are different in terms of cognition structure (mental model). Experts have organized their knowledge into complex structures that link the abstract conceptualizations of the domain with the surface features of the system (Chi, Glaser, & Rees, 1982; Chi, Feltovich, & Glaser, 1981). The development of knowledge/expertise is acquired in such a way that it is highly connected and articulated, so that inference and reasoning are enabled, as is access to procedural

actions. In short, those organizations of knowledge provide a schema for thinking and cognitive activity.

2. The structures of knowledge expertise/skills are developed. The work of Laufer & Glick (1996) proved that the four major interactive skill components that expert performers coordinate when troubleshooting: system, procedural, strategic knowledge (macro-level cognitive skills architecture) and strategic decision factors (inform the decision-making process of strategic knowledge).
3. Learning/expertise is a continuum. The progression can be described in terms of three interactive phases: (a) external support; (b) transition (c) self-regulation (Glaser, 1996). At each different phase, the use of external support with the performer calling on competitors, performance situations, and the advice of coaches as particularly needed is very selective. In this regard, we should design improved and supportive environments for different kinds of learning (performance) (accordingly)

Putting it all together, we believe (a) cognitive performance models believed to be detailed enough to provide the criterion performance for an instructional system; (b) a developmental trajectory depicting the skill acquisition path from novice to expert; and (c) individual learning and performance differences that result in impasses or barriers along the skill acquisition trajectory (Gott & Lesgold, 2000) are important in learning/performance. Therefore, EPSS designers will be able to identify critical learning and support elements during the design process.

EPSS designers are interested in understanding how an integrated, un-simplified form of real-world competence evolves over time as well as in searching for detailed cognitive performance models that could drive effective instruction and then integrate them into learning systems (for effective learning), because real-world learning and problems are unpredictable, dynamic and complex.

Knowledge gained from these studies contributes to the design of optimal instructional processes for acquiring expertise, or at least facilitating its development. Most of the research cited above, however, is quite basic and was not guided by a desire to improve the process of designing EPSSs. What we would like to do here is describe an additional approach, *Activity Theory*, that has been emphasized in several recent research studies (Laufer & Glick, 1996; Jonassen & Rohrer-Murphy, 1999; Hung, 1999; Hung, Koh, & Chua, 2000; Hung & Wong, 2000)

### **Activity Theory**

According to Hung & Chen (2000) the basic structure of an activity consists of the (a) intended object to be achieved by (b) subjects involved within the context of (c) a community where work is mediated by (d) tools, (e) rules of the practice, and (f) division of labor (Cole & Engestrom, 1991; Jonassen & Rohrer-Murphy, 1999; Kuutti, 1996). Thus Activity cannot be understood or analyzed outside the context in which it occurs.

Activity theory originated within the cultural-historical school of Soviet Psychology and classical German philosophy (Wertsch, 1981; Hung, 1999; Jonassen & Rohrer-Murphy, 1999; Hung & Wang, 2000). Following that, it was subsequently followed up by current researchers in Social-Cultural Psychology, such as situated cognition, distributed cognition, activity theory, and other dimensions relating to social-cultural perspectives (Hung, Koh, and Chua, 2000). The fundamental notion is that there are close interrelations between the individual mind with others and the environment or authentic context(s). As an EPSS designer, we need to be more concerned with the context in which learning and performance occurs, as well as the design process itself.

Knowledge is socially constructed based on the processes of internationality, history, culture, and tool mediation. The production of any activity involves individuals, the object of the activity, the tools that are used in the activity, and the actions and operations that affect an outcome (Nardi, 1996; Hung, 1999). Rather than focusing on knowledge states and representations, the work of Laufer & Glick (1996) focuses on the activities in which people are engaged, the nature of their tools, the social relationships, the contextual factors, and the goals and outcomes of activity. As a result, "learning occurs only in the context of meaningful activity, it is important to analyze the activity and the contexts as part of instructional design process (Jonassen & Rohrer-Murphy, 1999)."

### **Implementations To EPSS Design**

Instructional designers should focus not only on the products or outcomes of learning but also on the historical and genetic processes that lead to the resultant phenomena. Hung, Koh, & Chua (2000) concluded two fundamental reasons for this.

1. Culture, though man-made, both forms and makes possible the workings of the human mind; thus, learning and thinking are always situated in cultural settings and always depended upon the utilization of cultural resources.
2. Because human action and learning are primarily socio-culturally situated, even when the individual sits in solitude and contemplates something, he or she is socio-culturally situated by virtue of the mediational means he/she employs

In addition, jobs are placing greater cognitive demands on workers. In job environments such as aviation, operating rooms, and command and control centers, especially where time-constrained decisions are critical to overall performance, there is a growing demand for cognitive analysis to support the design of job aids and training systems. Within these operational environments, cognitive analysis is evolving from research and development projects to applied cognitive analyses integrated with traditional instructional design processes (Redding & Seamster, 1994). Activity approach has been proposed in Laufer & Glicks' study (1996) for investigating an everyday work task by novices and experts.

Activity is not merely external behavior; rather, it is inextricably linked with consciousness. It is the key to understanding the relationship between consciousness and the objective world. Hence, conscious learning emerges from activity or performance, not a precursor of it. For this reason, activity theory has been introduced and used in the field of human-computer interaction (Bodker, 1991), constructivist learning environments (Jonassen & Rohrer-Murphy, 1999) and instructional design (Wilson, 1999) in order to provide a clear operational framework for designing complex learning/support systems.

These studies all emphasize the need to consider the larger context. They place an emphasis on social interaction within an activity context and the processes of internalization that take place through interaction and mediation. In this regard, EPSS designers need to understand the performer culture (organization culture) and work environment (learning context) to at least some extent in order to negotiate the needs (based on the situations) and design effective products (Wilson, 1999; Jonassen & Rohrer-Murphy, 1999; Hara & Schwen, 1999; and Hung, 1999)

The main contribution of this activity framework is that it proposes a different perspective for analyzing (examining of) work practices, as performed by people within natural settings. The framework is most useful in both ill-defined and well-defined task areas where routing and non-normal tasks have been specified through a task analysis or the ISD process. Recognizing the wide range of cognitive analysis methods, this framework (approach), in addition to the methods in ISD process, allows for studying different forms of human practices, factoring in the processes of context as developmental process, both at the individual and social levels at the same time (Kuutti, 1996; Hung & Wong, 2000).

Activity theory's approach to instructional design is clearly based on distinctly different epistemic and pedagogical assumptions than classical approaches to instructional design. According to Jonassen & Rohrer-Murphy (1999), activity provides an alternative perspective to the mentalistic and idealist views of human knowledge that claim that learning must precede activity. Activity theory posits that conscious learning emerges from activity (performance), not as a precursor to it. So activity theory provides us with an alternative way of viewing human thinking and activity. Activity theory is also a powerful socio-cultural and socio-historical lens through which we can analyze most forms of human activity.

In short, activity theory provides an alternative framework for designing effective systems by understanding the expertise of particular task/knowledge/performance, expert [as well as novice] behaviors (mental model, goals, rules, intention, motivation, social interaction), and learning context (culture, tools, objects, environments).

## **Conclusion**

It is exciting that the development of technology provides many opportunities to enhance performance (and learning) that will involve EPSSs and other forms of environmental modification. In addition to employing classic instructional design methods, EPSS designers are aware of alternative approaches for designing and developing good instructional systems, such as rapid prototyping methodology (Jones & Richey, 2000) and concurrent engineering (Gustafson, 2000). At another level, the design of these modalities will also require alternative (or mixed/combination) approaches (such as activity approach) to understand change from a socio-culture perspective of focus from performance outcome to performance activity and the relationship of learning with their environment where learning and activities take places.

We need to design more effective EPSSs as the demand increases. It is important to know the difference between experts and novices because we can know how knowledge is transferred and how novices become experts

as well as how instructional designers can support these people effectively based on the notion that different performance requires different support. However, to reach this goal, particular attention should be given to the question of how we design the environment (support system) of people and things about them, and use the situations they encounter to improve their performance. It would also be informative for EPSS designers to understand the properties of different disciplines and different situations of performance that are more or less amenable to designing conditions for improvement, and that require various kinds of participatory experiences and assisting devices for supporting performance in the course of acquiring competence.

Equipped with all the understanding and knowledge described above of how technical expertise appears to grow in the wild, the initial state of the learner and an explication of the process of learning (i.e., the transition from initial state to a desired state in an instructional setting), learners' individual differences, and the assumption of learning mechanisms (internalization, assimilation, and restructuring; Gott & Lesgold, 2000), we are ready to turn our attention to designing an instructional environment that could effectively reproduce such expert-like performance, but through systematic learning events, accelerating the lengthy process that occurred naturally (Gott & Lesgold, 2000).

With these theories, techniques and knowledge that make the knowledge structures and cognitive performance of competence explicit, knowable, and learnable, we believe a properly designed instructional environment could shorten the skill acquisition process, resulting in accelerated skill development for a group of novice learners.

## Reference

- Aster, D. J., & Clark, R. E. (1985). Instructional software for users who differ in prior knowledge. Performance & Instruction Journal, 24(5), 13-15.
- Backler, M. (1988). Modeling expertise for instruction: An example from the auditing profession. Ph.D. thesis, Indiana University.
- Bodker, S. (1991). Activity theory as a challenge to systems design. In H. E. Nissen, H. K. Klein, & R. Hirschheim (Eds.), Information systems research: Contemporary approaches and emerging traditions. Amsterdam: Elsevier.
- Bredo, E. (1994). Reconstructing educational psychology: Situated cognition and Deweyan pragmatism. Educational Psychologist, 29(1), 23-35.
- Brown, C., Hedberg, J., & Harper, B. (1994). Metacognition as a basis for learning support software. Performance Improvement Quarterly, 7(2), 3-26.
- Brown, J., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. Educational Researcher, 18(1), 32-42.
- Charness, N. (1979). Components of skill in bridge. Canadian Journal of Psychology, 33, 1-16.
- Chase, W. G., & Simon, H. A. (1973). Perception in chess. Cognitive Psychology, 4, 55-81.
- Chi, M., Feltovich, P., & Glaser, R. (1981). Categorization and representation of physics problems by experts and novices. Cognitive Science, 5, 121-152.
- Chi, M., Glaser, R., & Rees, E. (1982). Expertise in problem solving. In R. Sternberg (Ed.), Advances in the Psychology of Human Intelligence. Hillsdale, NJ: Erlbaum.
- Cole, M., & Engestrom, Y. (1991). A cultural-historical approach to distributed cognition. In G. Salomon (Ed.), Distributed cognitions: Psychological and educational considerations. Cambridge, UK: Cambridge University Press.
- DeGroot, A. D. (1965). Thought and choice in chess. The Hague: Moulton.
- Dickelman, G. (2000). Performance support in internet time: The state of the practice. Performance Improvement Quarterly, 39(6), 7-17.
- Dunn, T. G., & Taylor, C. A. (1989). Hierarchical structures in expert performance. Educational Technology Research & Development, 38(2), 5-18.
- Ericsson, K., & Charness, N. (1994). Expert performance: Its structure and acquisition. American Psychologist, 49(8), 725-747.
- Feltovich, P., Ford, K., & Hoffman, R. (1997). Expertise in context: Human and machine. Menlo Park, CA: AAAI Press.
- Gardner, H. (1995). Why would anyone become an expert? American Psychologist, 50(9), 802-803.
- Gery, G. (1991). Electronic performance support systems. Boston, MA: Weingarten Publishers.
- Glaser, R. (1990). The reemergence of learning theory within instructional research. American Psychologist, 45(1), 29-39.

- Glaser, R. (1991). The maturing of the relationship between the science of learning and cognition and educational practice. Learning & Instruction, *1*(2), 129-144
- Glaser, R. (1996). Changing the agency for learning: Acquiring expert performance. In K. A. Ericsson (Ed.), The road to excellence: The acquisition of expert performance in the arts and sciences, sports, and games. Mahwah, NJ: Lawrence Erlbaum Associates.
- Gobet, F. (1998). Expert memory: A comparison of four theories. Cognition, *66*(2), 115-152.
- Gott, S. P., & Lesgold, A. M. (2000). Competence in the workplace: How cognitive performance models and situated instruction can accelerate skill acquisition. In R. Glaser (Ed.), Advances in instructional psychology: Educational design and cognitive science. Mahwah, NJ: Lawrence Erlbaum Associates.
- Gustafson, K. (2000). Designing technology-based performance support. Educational Technology, *40*(1), 38-44.
- Hara, N., & Schwen, T. (1999). An instructional development model for Global organizations: The GoaL model. Performance Improvement Quarterly, *12*(4), 99-116.
- Hung, D. (1999). Activity, apprenticeship, and epistemological appropriation: Implications from the writings of Michael Polanyi. Educational Psychologist, *34*(4), 193-205.
- Hung, D., & Chen, D-T. (2000). Appropriating and negotiating knowledge: Technologies for a community of learners. Educational Technology, *40*(3), 29-32.
- Hung, D., Koh, T., & Chua, C. (2000). Social-cultural perspectives of R & D in educational technology. Educational Technology, *40*(4), 29-32.
- Hung, D., & Wong, A. (2000). Activity theory as a framework for project work in learning environments. Educational Technology, *40*(2), 33-37.
- Jeffries, R., Turner, A. A., Polson, P. G., & Atwood, M. E. (1981). The processes involved in designing software. In J. R. Anderson (Ed.), Cognitive skills and their acquisition. Hillsdale, NJ: Erlbaum.
- Jones, T. S. & Richey, R. C. (2000). Rapid prototyping methodology in action: A developmental study. Educational Technology Research & Development, *48*(2), 63-79.
- Johnson, S. D. (1988). Cognitive analysis of expert and novice troubleshooting performance. Performance Improvement Quarterly, *1*(3), 38-54.
- Jonassen, D., & Rohrer-Murphy, L. (1999). Activity theory as a framework for designing constructivist learning environments. Educational Technology Research & Development, *47*(1), 61-79.
- Julian, M. F., Larsen, V. A., & Kinzie, M. B. (1999). Compelling case experiences: Challenges for emerging instructional designers. Proceedings of selected research and development papers presented at the 21<sup>st</sup> National Convention of the Association for Educational Communication and Technology, 7-28.
- Kaplan, C. A., & Simon, H. A. (1990). In search of insight. Cognitive Psychology, *22*(3), 374-419.
- Kasvi, J., & Vartiainen, M. (2000). Performance support on the shop floor. Performance Improvement Quarterly, *39*(6), 40-46.
- Kasvi, J., Vartiainen, M., Pulkkis, A., & Nieminen, M. (2000). The role of information support systems in the joint optimization of work systems. Human Factors and Ergonomics in Manufacturing, *10*(2), 193-221.
- Kuutti, K. (1996). Activity theory as a potential framework for human-computer interaction research. In B. A. Nardi (Ed.), Context and consciousness: Activity theory and human-computer interaction. Cambridge, MA: MIT Press.
- Larkin, J., McDermott, J., Simon, D., & Simon, H. (1980). Models of competence in solving physics problems. Cognitive Science, *4*, 317-345.
- Laufer, E. A., & Glick, J. (1996). Expert and novice differences in cognition and activity: A practical work activity. In Y. Engestrom & D. Middleton (Eds.), Cognition and communication at work (pp. 177-198). New York: Cambridge University Press.
- Le Maistre, C. (1998). What is an expert instructional designer? Evidence of expert performance during formative evaluation. Educational Technology Research & Development, *46*(3), 21-36.
- Leont'ev, A. N. (1978). Activity, consciousness, and personality. Englewood Cliffs, NJ: Prentice-Hall.
- Lewis, C. (1981). Skill in algebra. In J. R. Anderson (Ed.), Cognitive skills and their acquisition. Hillsdale, NJ: Erlbaum.
- Li, Z., O'Neil, H., Jr., & Baker, E. (1991). Developing a research reference interface for knowledge-based instructional design tools. Educational Technology, *31*(8), 7-16.
- McPherson, S. L. (2000). Expert-novice differences in planning strategies during collegiate singles tennis competition. Journal of Sport & Exercise Psychology, *22*, 39-62.
- Nardi, B. A. (1996). Studying context: A comparison of activity theory, situated action models, and distributed cognition. In B. A. Nardi (Ed.), Context and consciousness: Activity theory and human-computer interaction. New York: Wiley.

- Patel, V. L., & Groen, G. J. (1986). Knowledge based solution strategies in medical reasoning. Cognitive Science, 10, 91-116.
- Perez, R. S., & Emery, C. D. (1995). Designer thinking: How novices and experts think about instructional design. Performance Improvement Quarterly, 8(3), 80-95.
- Perez, R. S., Johnson, J. F., & Emery, C. D. (1995). Instructional design expertise: A cognitive model of design. Instructional Science, 23, 321-349.
- Randel, J. M., & Pugh, H. L. (1996). Differences in expert and novice situation awareness in naturalistic decision making. International Journal of Human-Computer Studies, 45, 579-597.
- Raybould, B. (1990). Solving human performance problems with computers. Performance & Instruction, 29(10), 4-14.
- Raybould, B. (1995). Performance support engineering: An emerging EPSS development methodology for enabling organizational learning. Performance Improvement Quarterly, 8(1), 7-22.
- Richman, H. B., & Simon, H. A. (1989). Context effects in letter perception: Comparison of two theories. Psychological Review, 96(3), 417-432.
- Rowland, G. (1992). What do instructional designers actually do? An initial investigation of expert practice. Performance Improvement Quarterly, 5(2), 65-86.
- Schoenfield, A. H., & Herrmann, D. J. (1982). Problem perception and knowledge structure in expert and novice mathematical problem solvers. Journal of Experimental Psychology: Learning, Memory, and Cognition, 8, 484-494.
- Scribner, S. (1990). Manufacturing resource planning. Paper presented at the Second International Congress on Activity Theory. Lahti.
- Simon, H. A. (1981). Information-processing models of cognition. Journal of the American Society for Information Science, 32(5), 364-377.
- Simon, H. A. (1993). Decision making: Rational, nonrational, and irrational. Educational Administration Quarterly, 29(3), 392-411.
- Ste-Marie, D. M. (1999). Expert-novice differences in gymnastic judging: An information-processing perspective. Applied Cognitive Psychology, 13, 269-281.
- Stepich, D. (1991). From novice to expert: implications for instructional design. Performance & Instruction, 30(6), 13-17.
- Taylor, J. C. (1994). Novex analysis: A cognitive science approach to instructional design. Educational Technology, 34(5), 5-13.
- Tennyson, R. D. (1992). An educational learning theory for instructional design. Educational Technology, 32(1), 36-41.
- Wertsch, J. V. (Ed.) (1981). The concept of activity in Soviet psychology. White Plains, NY: M. Sharpe.
- Wilson, B. G. (1999). Adoption of learning technologies: Toward new frameworks for understanding the link between design and use. Educational Technology, 39(1), 12-16.
- Winslow, C., & Bramer, W. (1994). Future work: Putting knowledge to work in the knowledge economy. New York: Free Press.
- Witt, C., & Wager, W. (1994). A comparison of instructional systems design and electronic performance support systems design. Educational Technology, 34(4), 20-24.
- Yacci, M. (1999). The knowledge warehouse: Reusing knowledge components. Performance Improvement Quarterly, 12(3), 132-140.



# A Design and Development Model for Building Electronic Performance Support Systems

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## Abstract

*The proposed study is to investigate the design and development process of EPSSs. The primary purpose of this study is to help the EPSS designers by proposing a more effective and productive EPSS design and development model. By analyzing EPSS products and observing EPSS design projects, the researcher will propose a design model for future EPSS designers.*

## Introduction

The recent developments of technologies have been changing the way we live. Many organizations, such as business, educational or governmental settings have been challenged to integrate information technologies into their work settings. Parallel to this change, in the past decade, there has been a significant shift from traditional training and instructional systems to performance-based, individualized and just-in-time support.

As stated by Hung (1998), today's organizations convey the ineffectiveness of traditional performance support interventions, represented by both traditional training and traditional performance support technologies. Traditional interventions have helped a little, but not significantly, to move the organization successfully into the performance zone. Moreover, according to Rosenberg (1995), for a performance-based approach the concepts of students, courses, curricula and instruction have little meaning. Rosenberg, Coscurelli, and Hutchinson (1999) note that:

The overwhelming amount of complex information required to perform work at a competent level has placed considerable strain on traditional education and training systems. This situation has led to the development of job aids, computer databases, and electronic training systems as well as of structured text design. (p.30)

Therefore, especially because of the wide availability of new information technologies, knowledge-based organizations, such as educational institutions and corporations, have started to implement and use Electronic Performance Support Systems (EPSS) to increase both performance and productivity.

Laffey (1995) indicates the goal of an EPSS as providing whatever is necessary to ensure performance and learning at the moment of need. It is agreed upon by several researchers (Gery, 1989; Gery, 1995; Raybould, 1995; Lawton, 1999; Gustafson, 2000) that, in order to improve performance and reduce the time spent on task, the ultimate goal of an EPSS is to provide performers with the right information, in the right quantity and detail, at the right time. In those respects, EPSS is different from traditional training systems.

With the help of such systems, performers receive support during performance, rather than before they perform their jobs. Laffey (1995) adds that an EPSS is not only a vehicle for delivering static information, but also a reconceptualization of the work environment that is grounded in the fluid nature of support in the work environment. This is a major shift from the traditional approach to training.

As pointed out by Raybould (2000), the major question facing organizations today is not whether to do performance-centered design, but how to get it done. Since the ultimate goal of EPSSs is to reduce the cost of training while increasing productivity and performance, they have been developed and used by many organizations during the last decade.

As stated above, EPSSs are different from traditional training and instructional systems, because their primary purpose is to support performers while doing their actual job. According to Rosenberg (1995), EPSS is a fundamental paradigm shift in thinking, and it requires a broader perspective about what is possible in improving human performance. Rosenberg criticizes many educators because they are locked in a linear cultural model that focuses on learning as an end and instruction as a means, both of which contrast with the means and ends of EPSS. This difference also makes the EPSS design and development process different. Since the overall purpose of an EPSS is different from the traditional purpose of instruction, several researchers (Milheim, 1997; Northrup, 1999) state that the use of traditional instructional system development models is inadequate for EPSS development. Northrup (1999) summarizes this difference as "instructional design is the process of designing and developing instruction to achieve specific learning outcomes, where EPSS is more focused on producing task performance" (p.

1). Rosenberg (1995) adds that involvement in building and implementing EPSSs requires a fundamental rethinking of the relationship between learning and performance. Parallel to this, the design and development of more effective EPSSs is becoming a critical issue that needs to be focused on by researchers. Therefore, since EPSS has significant differences from instruction, then the approach to its design/development process should also be different.

### **Significance of the Study**

Several researchers state the need for a clear methodology for building EPSSs (Fisher & Horn, 1997; Gustafson, 2000; Milheim, 1997). Cote (2000) states that the focus on the "work process" makes the design and development of an EPSS quite different than the traditional models of instructional design. If the primary purpose of an EPSS is to support performance, learning is of secondary importance; and if an EPSS is different than instruction, how should it be designed?

Despite a growing number of success stories, the EPSS remains a relatively new concept and little is known about the different aspects of EPSS design. This study will create a better understanding of the EPSS design process. By observing and analyzing EPSS design projects in different phases of the production path, the researcher will propose a design model for future EPSS developers.

For this study, rather than having in-depth analysis of individual steps, the focus will be on the generic design process, with the major components that reflect the patterns of design activities carried out by EPSS designers in the field. Identifying the underlying detailed steps is beyond the scope of this study. They can be addressed in future studies.

### **Literature Review**

It is generally agreed upon that Gloria Gery is the first person who introduced the term EPSS at the end of the 1980s (Gery, 1989). Gery (1989) and Brown (1996) define an EPSS as a self-contained, online system which is designed to integrate a knowledge base, expert advice, learning experiences, and guidance with the goal of providing individuals with the ability to perform at a higher level in the workplace and requires minimal support and intervention by others. Another EPSS pioneer Raybould (1995) defines EPSS as

...the electronic infrastructure that captures, stores, and distributes individual and corporate knowledge assets throughout an organization, to enable individuals to achieve required levels of performance in the fastest possible time and with a minimum of support from other people. (p. 11)

Later, Gustafson broadens those dimensions by including multiple knowledge sources, expert systems or artificial intelligence, contextual multimedia instruction and more sophisticated tools (Gustafson, 2000).

As seen from the literature, EPSS is still a young and evolving field (Moore, 1998). Therefore, even though the term EPSS has been widely used recently, there is no generally agreed-upon definition (Cole, Fischer & Saltzman, 1997; Villachica & Stone, 1999; Hannafin, Hill & McCarthy, 2000). According to Brown (1996), the best use of an EPSS happens under the following circumstances: if there is a profusion of information required to perform work at a competent level and technology explosions exist, experts are not available, expectations for performers are high, and performers have a self-directed learning style.

Similar to the case of different definitions of EPSS, there are also different views about the components and characteristics of EPSS. For example, Schwen et al. (1993) argue that an EPSS has four characteristics: information management, collaboration management, productivity through embedded guidance and work metaphor, and finally a problem solving environment that integrates basic tools, information management, collaboration and productivity tools in a seamless environment.

Hannafin et al. (2000) list the four core components of EPSS as resources, contexts, tools, and scaffolds. The ways in which the varied elements within the components are combined will vary depending upon the goals, context, and participants.

Reigeluth (1999) defines an EPSS as a computer program that provides support for the performance of a task. According to him, an EPSS usually has four major components: a database, an expert system, an instructional system and tools. These components are explained below:

- A database. A store of information that can be accessed by keywords or topical menus during the performance of a task. In addition, the database could provide access to other tools or software to help the worker do his or her job, such as spreadsheet and word processing software. "The EPSS would integrate tutorials or instructional systems and expert systems into the database, both in order to make them context-sensitive, and to allow them to share data" (Sleight, 1993, p.7). The type of data in this database may be textual, numeric, visual (photographs and video), or audio (conversations, speeches, and

music). The information would be linked with related information via non-linear hypertext links, providing fast access to information, and allowing for different levels of knowledge in users. The effectiveness of an EPSS strongly depends on how well the database matches with the user's task and environment.

- *An expert system.* An expert system is a computer-based system, which emulates the decision-making ability of a human expert (Jonassen & Reeves, 1996). It can be accessed as an expert is accessed—by asking questions or receiving unsolicited suggestions—during performance of a task. It may suggest the most appropriate procedure or step to do next. Today, the terms expert system, knowledge-based system, and knowledge-based expert system are used synonymously.
- *An instructional system.* A set of methods (such as providing hints, suggestions, and guidance to move the student along) of instruction to help performers just in time for performance. It may be a list of steps to take, a motion video showing a procedure, or a simulation of a task that allows the user to practice.
- *Tools.* Programs that a performer uses to perform specific tasks, such as grade book programs, electronic notebooks, spreadsheets, statistical analysis packages, and even e-mail programs and Web browsers.

Reigeluth states that the Human-Computer-Interface (HCI) aspect of EPSS covers all these components and can be thought of as an umbrella under which all of the other components are located.

### **What Makes EPSS Different?**

As stated in the previous pages, it is generally agreed among EPSS experts that an EPSS is different from an instructional system (IS) in many respects. One of the most important differences is its main focus, which is performing rather than learning. In their article, Witt and Wager (1994) compare EPSSs with instructional systems to highlight the differences between them. They argue that an instructional system is “a product that contributes to the achievement of some type of learning outcome,” and instruction has methods “for bringing about desired changes in student knowledge and skills for a specific course content and a specific student population” (p. 20). In contrast, “while learning may occur during the use of electronic performance support, its primary purpose is to facilitate performance of a task; learning is of secondary importance” (p. 20).

The second important difference between IS and EPSS is using EPSS while doing the actual job, not beforehand. On this aspect, Cole et al. (1997) state that EPSS is actually a paradigm shift for training organizations because in EPSS “knowledge delivery takes place soon enough that is applied to the appropriate situation, and late enough that the user does not have to go through training or information overload” (p. 50).

The third difference reported is that people do not need to follow a predetermined sequence while using the EPSS. A novice and an expert may use it differently. In addition to this, in an instructional system it is assumed that the terminal requirements of an instructional product are predetermined (Witt & Wager, 1994). According to Ryder and Wilson (1996), if the content is well-defined and stable, and it is based on algorithms and rules, an instructional system becomes the best solution. However, an EPSS provides contextually relevant information for a dynamic environment (Laffey, 1995)

As seen until this point, even though there are some similarities between Instructional Systems and EPSSs, the differences are important. For certain kinds of well-defined content within stable training environments, instructional systems may work satisfactorily. However, as stated by Wilson, Jonassen, and Cole (1993), the limitations of this approach become apparent when working in ill-defined content domains, which requires self-pacing and creativity or when working with highly diverse populations.

### **Need for an EPSS Design/Development Approach**

As seen in the previous section, EPSSs are significantly different from instructional systems. Therefore, as stated by Witt and Wager (1994), the fundamental differences of purpose between the two products indicate that different methodologies need to be used to create them. Laffey (1995) emphasized that EPSSs will no longer be simply extensions of what we know about instructional design and the design of databases. The same point is made by Gustafson (2000) that the design of EPSSs requires alternative (or mixed) methods. Finally, the lack of well-established design models is obvious from the literature. For example, Gery (1995) states,

Few [EPSSs] are guided by a set of integrated and fully articulated design principles. Many innovations are the result of individual or team creativity and iterative design employing rapid prototyping coupled with ongoing usability and performance testing (p. 48)

### **Current Approaches to EPSS Design/Development and Their Problems**

There is a broad consensus that there is a lack of well-defined EPSS design and development models (Gustafson, 1993; Gustafson, 2000; Milheim, 1997; Laffey, 1995; Rosenberg, Coscarelli & Hutchison, 1999), and information that describes how people have actually designed and developed EPSSs is also insufficient (Gery, 1989b). As stated by Dickelman (1996) even though the definition of EPSS is clear for many people, they cannot tell you “how to go about doing it”.

According to Gustafson (2000), there are three main reasons for this lack of information. First, since many EPSSs are developed by commercial organizations and are their property, they do not share this information with others. Winer et al. (1999) also support this argument. They state that because of competitive advantage and strict confidentiality regulations, it is difficult to obtain data about specific EPSS developments. Second, the history of EPSS is no more than 10-12 years. Therefore, procedures have not been well developed and tested. Gery (1995a) supports the view that since EPSS is relatively new, it is difficult to define a detailed development methodology for EPSS. Finally, Gustafson reports the third reason, as “. some EPSS designers may be reluctant to talk about what they have done, since they are unable to clearly articulate specific and replicable procedures.” (p. 42).

In the literature, EPSS designers have used classical instructional design approaches (e.g. ADDIE) (Benko & Webster, 1997; Graham & Sheu, 2000), a modification of ED<sup>4</sup> (an instructional design and development methodology from Digital Equipment Corporation) (Brown, 1996), rapid prototyping (Tripp & Bichelmeyer, 1990; Law, Okey & Carter, 1995), prototyping and layers of necessity (Wedman & Tessmer, 1991; Northrup et al., 1998), or combination of them (Gustafson, 2000). Witt and Wager (1994) report that large companies modify the ISD models “to meet the unique challenges and complexities of EPSS solutions.” (p. 20)

However, as stated by several researchers (Wilson, 1999; Rosenberg, Coscarelli & Hutchison, 1999), ID models have several limitations in performance support systems development. The most significant problem with them is that they generally analyze the job tasks to identify whether someone can perform the task or not. Performance support is concerned with providing information and assistance when the employee needs it and how they need it (Witt & Wager, 1994). Rosenberg et al. (1999) report the necessity of a paradigm change to performance technology systems development models.

Habelow (2000) also raises the issue of the difference between the EPSS design process and ISD, and she discusses the need for involvement of other disciplines. She states

... most organizations have their own customized version of an ISD process that is used as an approach to the design of EPSS applications. With such a striking difference in perspective, learning versus performance, a new model of EPSS design and development that combines the instructional value of education focused models and incorporates a more technological perspective of computer and information systems models may be warranted. (p.76)

Raybould (1995) suggests that the methodology for developing this electronic infrastructure must have a wider scope than other existing methodologies. He emphasizes the need for involving different elements in EPSS design methodology, namely human performance technology, instructional systems development, computer based training, information engineering, business process reengineering, knowledge engineering and technical writing and interface design (Raybould, 1995; Raybould, 2000).

## **Help from Other Fields**

As stated above, an EPSS is composed of several modules or components. The implementation process needs to be based on multiple theories and approaches. Therefore, the process of building those components in an integrated manner has to be a multidisciplinary approach. Raybould (2000) calls this approach Performance Support Engineering (PSE).

For a successful EPSS design/development process, Hannafin, Hill and McCarthy (2000) emphasize the importance of welcoming other approaches that emerged outside of our traditional community, in other related disciplines. Similar to other researchers, they also agree on the multidisciplinary nature of EPSS design, stating that:

EPSS design practices represent a convergence among several related fields and specialties, including human performance technology, computer-supported collaborative work, technical communications, electronic publishing, instructional design, and workplace training. (p. 3)

Similarly, Gustafson (2000) affirms this view and argues that EPSS design/development is an immature technology, so exploring other disciplines and applying their related methodologies will definitely make a significant contribution to the work in EPSS design/development.

It is obvious that EPSS design and development is a complex and multidisciplinary process. Among the several methodological approaches that I have found in the literature, there are two approaches that look very promising for building a model for the EPSS design and development process. Multiview is one of them, which

comes from Information Science, one of the Soft System Methodologies (SSM). The second one is Chaos Theory, which is related to SSM and ISD. Since the EPSS design and development process is so complex, Chaos Theory might provide us with a new perspective to better understand this process. It is this researcher's initial intuition that an EPSS has similar characteristics to a chaos system.

### **Information Systems Design and EPSS**

According to Villachica and Stone (1999), Information Systems (IS) development models offer detailed strategies that can be applied to EPSS creation. Cole et al. (1997) also agree on this view and argue that EPSSs should adhere to general software engineering methods. Furthermore, Gustafson (2000a) strongly encourages the researchers in IST to look more at approaches in Information Science discipline. Foshay et al. (1999) capture the essence of building human performance theory from IS by stating that IS principles "define a common ground between HPT [Human Performance Technology] and information science" (p. 899). According to them three branches of IS support HPT: Information Technology, Information Systems and Information Management.

Complex projects and unsuccessful attempts to realize them is a common problem for many disciplines/fields. Recently, a systemic approach to this kind of problem-solving has been provided in a methodology developed by Peter Checkland, Professor of Systems at Lancaster University, UK. This is known as the Soft Systems Methodology (SSM) (Checkland & Scholes, 1990). It was developed to overcome the limitations of the conventional systems analysis approaches. Such approaches are prescriptive and emphasize the "hard" aspects of the problem domain, which is the certain and the precise. However, Soft Systems Methodology is designed to allow the human element of such systems to be incorporated into system design work, and both technical and non-technical issues are explicitly addressed. It is most appropriate for systems that are complex and ill-structured (Finegan, 1994; Bennetts & Wood-Harper, 2000).

A well-known design framework from IS, which seems a promising approach for building an EPSS design/development model, is Multiview (Avison, 1996). Multiview contrasts with traditional IS design methodologies, where "the steps are prescribed in great detail and are expected to be followed rigorously in all situations" (Avison & Wood-Harper, 1990, p.13). Multiview is perhaps the most famous attempt at combining hard systems and soft systems philosophies.

As stated by Raybould (2000), a very important aspect of performance support engineering is its focus on human elements as well as computer elements. Therefore, I believe several aspects of Multiview, specifically SSM and STD, will best fit for the development of an EPSS design model.

From my practical experiences, both in IS and ISD, I see that traditional development methods are only used in theory. As stated by Raccoon (1995a), the practical development of such systems has always followed complex life cycles. Rather than phases being followed rigidly, they come and go as the project evolves. This is the same pattern that nature follows. The weather, political systems, economy, society and all other complex systems do not follow a predetermined path. Rather, they show a chaotic path. Therefore, I believe that, while exploring the EPSS design and development process, it is worthwhile looking at Chaos Theory. In the following section, this approach will be explored briefly.

### **Chaos Theory (Dynamic Systems or Adaptive Development)**

Several researchers agree that the traditional systems approach to problem solving has a reductionist nature and it tends to solve a problem by fragmentation, one stage at a time (Finegan, 1994; You, 1993; Jonassen, 1990). This approach may work for some small scale and well-defined situations. However, the systems associated with human activity are complex and not well-defined. According to Jonassen (1990) "simple systems behave in simple ways, and complex systems behave in complex and less predictive ways. The behavior of a system cannot be examined accurately by analyzing its components" (p. 34). As an alternative to a linear, reductionist and deterministic approach, Chaos or the dynamical systems approach is proposed. In a complex system "the components are related and interlock with one another such that a change in one component invariably affects another part of the system, or eventually even the entire system" (Murnare, cited in Chiew, 1991, p.25). Gordon and Greenspan explain Chaos as the study of disorder, and it appears in non-linear systems (as cited in King, 1991). Since Chaos deals with non-linear and disorderly systems, many disciplines, including technological, social and economic, are appropriate for applying its principles. As stated by Highsmith (2000) "from physics to biology to chemistry to evolution, complex adaptive systems theory began to help explain occurrences in the real world that the linear approximations of the old science could not" (p. 10). According to King (1991), for many different disciplines, Chaos gives new data, suggests innovative approaches to old ideas, and reaffirms certain approaches.

As pointed out by Hannafin, Hill and McCarthy (2000), "EPSS systems have evolved into larger and more complex environments" (p. 32). They do not have fixed features and components. In addition to this, especially in complex domains, "an effective performance requires expertise beyond the skill level" (Sinita, 2000, p.18) and performers follow unpredictable patterns that are discontinuous and complex (Paulson & Paulson, cited in You, 1993, p. 24). As a result, such factors make the design process itself less systematic and more situated (Sherry & Wilson, 1996). EPSS development does not operate in isolation, and not done in a linear manner (Ho & Hara, 2001). However, this life cycle is interdependent and connected.

To summarize, the EPSS design/development process has a complex nature. To the extent that it is similar to IS development, EPSS development is at the edge of technology, and it requires a mixture of chaos-based top-down and bottom-up processes (Raccoon, 1995b).

## References

- Avison, D.E. (1996). Information systems development methodologies: A broader perspective. In S. Brinkkemper, K. Lyytinen & R.J. Welke (Eds.), Method Engineering: Principles of method construction and tool support. pp. 263-277. Chapman&Hall.
- Avison, D.E. & Wood-Harper, A.T. (1990). Multiview: An Exploration in Information Systems Development. Oxford: Blackwell Scientific Publications.
- Benko, S. & Webster, S. (1997). Preparing for EPSS project. Communications of the ACM, 40 (7), 60-63.
- Bennetts, P.D.C. & Wood-Harper, A.T., (2000). A Model of Software Process Improvement from a Systemic Perspective. In Proceedings of The Eleventh Australasian Conference on Information Systems, December 2000, Brisbane, Australia. [On-line] Available at: <http://www2.fit.qut.edu.au/ACIS2000/ACIS%20papers/paper%20bennetts.pdf>
- Brown L.A. (1996) Designing and Developing Electronic Performance Systems. Digital Press, Boston.
- Checkland, P. & Scholes, J. (1990). Soft Systems Methodology in Action. John Wiley & Sons: Chichester.
- Chiew, J. (1991). An Alternative Approach to Educational Planning Based on a Conceptual Framework of the Educational System as Dynamic: A Theoretical Study. Unpublished Doctoral Dissertation. Florida State University, Tallahassee.
- Cole, K., Fischer, O, & Saltzman, P. (1997). Just-in-time Knowledge Delivery: A case study of an award-winning support system demonstrates the vital characteristics and primary design goals for generating peak performance. Communications of the ACM, (40) 7, 49-53.
- Cote, D. (2000). EPSS Tutorial. Electronic document: Web site was accessed by March 19, 2000, URL: <http://home.istar.ca/~djccote/epss/main.htm>
- Dickelman, G.J. (1996). Gershom's Law: Principles for the Design of Performance Support Systems Intended for Use by Human Beings. CBT Solutions Magazine, Sept./Oct. 1996. [http://www.pcd-innovations.com/law/cbt\\_art.html](http://www.pcd-innovations.com/law/cbt_art.html)
- Finegan, A. (1994). Soft systems methodology: an alternative approach to knowledge elicitation in complex and poorly defined systems. Complexity International, 1, Paper ID: finega01. [On-line] Available at: <http://www.csu.edu.au/ci/vol01/finega01/>
- Fischer, O. & Horn, R. (1997). Electronic Performance Support Systems. Communications of the ACM, 40 (7), 31-32.
- Foshay, W.R., Moller, L., Schwen, T.M., Kalman, H.K. & Haney, D.S. (1999). Research in Human Performance Technology. In H.D. Stolorvitch and E.J. Keeps (Ed.), Handbook of Human Performance Technology: Improving Individual and Organizational Performance Worldwide. Jossey-Bass, Pfeiffer, 1999.
- Gery, G. (1989). Electronic Performance Support Systems. Boston, MA. Weingarten Publications.
- Gery, G. (1989b). Training vs. Performance Support: Inadequate Training is Now Insufficient. Performance Improvement Quarterly, 2 (3), 51-71.
- Gery, G. (1995). Attributes and Behaviors of Performance-Centered Systems. Performance Improvement Quarterly, 8 (1), 47-93.
- Gery, G. (1995a). Electronic Performance Support Systems: How And Why To Remake The Workplace Through The Strategic Application Of Technology. Tolland, MA : Gery Performance Press, 1995
- Graham, C & Sheu, F.R. (2000). Performance Support for Doctoral Students. Paper presented in AECT 2000, Denver Colorado.
- Gustafson, K. (1993). Instructional Design Fundamentals: Clouds on the Horizon. Performance Improvement Quarterly, 33 (2) 27-32.

- Gustafson, K. (2000). Designing Technology-Based Performance Support. Educational Technology, 40 (1), 38-44.
- Gustafson, K. (2000a). Personal communication with Kent Gustafson.
- Habelow, E.M. (2000). Factors related to the use of an Electronic Performance System (EPSS). Unpublished Doctoral Dissertation, Temple University.
- Hannafin, M. J., Hill, J. R. & McCarthy, J. E. (2000). Designing resource-based learning and performance support systems. In D. A. Wiley (Ed.), The Instructional Use of Learning Objects: Online Version. Retrieved 3 15, 2001, from the World Wide Web: <http://reusability.org/read/chapters/hannafin.doc>
- Highsmith, J.A. (2000). Adaptive Software Development: A Collaborative Approach to Managing Complex Systems. Dorset House Publishing: New York.
- Ho, L. & Hara, N. (2001). A Designer's View of the Life Cycle of the Electronic Performance Support System. On-line, Accessed by July 17, 2001 <http://www.indiana.edu/~kiki/conference/informs99.html>
- Hung, W.C. (1998). An analysis of the developmental process in an electronic performance support system for behavior management in the classroom. Unpublished Doctoral Dissertation. Indiana University, Bloomington.
- Jonassen, D. H. (1990). Thinking technology: Chaos in instructional design. Educational Technology, 30(2), 32-34.
- Jonassen, D. H. & Reeves, T. C. (1996). Learning with technology: Computers as cognitive tools. In D. H. Jonassen (Ed.), Handbook of research for educational communications and technology. New York: Macmillan Library Reference USA.
- King, J.W. (1991). Chaos, Communication and Educational Technology. Paper presented at the annual meeting of AECT, Orlando, Florida. ED334988.
- Laffey, J. (1995). Dynamism in Electronic Performance Support Systems. Performance Improvement Quarterly, 8 (1), 94-99.
- Law, Okey & Carter (1995). Developing EPSS for Professionals. In M.R. Simonson & M. L. Anderson (Eds), 17<sup>th</sup> Annual Proceedings of Selected Research and Development Presentations at the 1995 National Convention of the Association for Educational Communications and Technology (pp. 309-315). Anaheim, CA, 1995. ED# 383284.
- Lawton, W. (1999). Electronic performance support systems and knowledge management – the merging ground. Electronic document: <http://www.boyblue.freemove.co.uk/wjlonline/dissertation.htm> (Accessed by May, 2001).
- Milheim, W. (1997). Instructional design issues for electronic performance support systems. British Journal of Educational Technology, 28 (2), 103-110.
- Moore, J.L. (1998). The Implementation of an Electronic Performance Support system for Teachers: An Examination of Usage, Performance, and Attitudes. Unpublished Doctoral Dissertation. University of Georgia.
- Northrup, P.T. & Pilcher, J.K. (1998). STEPS: An EPSS toll for Instructional Planning. ERIC 423 853.
- Northrup, P.T. (1999). Building the design framework and user interface for an EPSS. Paper presented in AECT Conference, Houston TX. Available online: [http://www.uwf.edu/pnorthru/AECT99/considerations\\_for\\_designing\\_eps.htm](http://www.uwf.edu/pnorthru/AECT99/considerations_for_designing_eps.htm)
- Raccoon, L. B. S. (1995a). The Chaos Model and the Chaos Life Cycle. Software Engineering Notes, 20 (1), 55-66.
- Raccoon, L. B. S. (1995b). The Chaos Strategy. Software Engineering Notes, 20 (5), 40-47.
- Raybould, B. (1995). Performance Support Engineering: An Emerging Development Methodology for Enabling Organizational Learning. Performance Improvement Quarterly, 8 (1), 7-22.
- Raybould, B. (2000). Performance Support Engineering: Building Performance-Centered Web-Based Systems, Information Systems, and Knowledge Management Systems in the 21st Century. Performance Improvement Journal, 39 (6), 32-39.
- Reigeluth, C.M. (1999). Personal communication in EPSS study group.
- Rosenberg, M.J. (1995). Performance Technology, Performance Support, and the Future of Training: A Commentary. Performance Improvement Quarterly, 8 (1), 94-99.
- Rosenberg, M.J., Coscarelli, W.C. & Hutchison, C.S. (1999). The Origins and Evolution of the Field. In H.D. Stolovitch and E.J. Keeps (Ed.), Handbook of Human Performance Technology: Improving Individual and Organizational Performance Worldwide. Jossey-Bass, Pfeiffer, 1999.
- Ryder, M. & Wilson, B. (1996). Dynamic learning communities: An alternative to designed instructional systems. Proceedings of Selected Research and Development Presentations at the 1996 National Convention of the Association for Educational Communications and Technology. Indianapolis, IN. 18th. Indianapolis, IN.

- Schwen, T.M., Goodrum, D.A., & Dorsey, L.T. (1993). On the design of an enriched learning and information environment (ELIE). Educational Technology, 33 (11). pp. 5-9.
- Sherry, L., & Wilson, B. (1996). Supporting Human Performance Across Disciplines: A Converging of Roles and Tools. Performance Improvement Quarterly, 9 (4), 19-36.
- Sinita, K. (2000). Learning Individually: A Life learning perspective. Educational Technology & Society, 3(1), pp. 17-23.
- Sleight, D. A. (1993). Types of Electronic Performance Support Systems: Their Characteristics and Range of Designs. Electronic Document: Web site was accessed by May 15, 2001, URL: [http://www.msu.edu/~sleightd/epss\\_copy.html](http://www.msu.edu/~sleightd/epss_copy.html)
- Tripp, S.D. & Bichelmeyer, B. (1990). Rapid Prototyping: An alternative instructional design strategy. Educational Technology Research and Development, 38(1), 31-44.
- Villachica, S.W. & Stone, D.L. (1999). Performance Support Systems. In H.D. Stolovitch and E.J. Keeps (Ed.), Handbook of Human Performance Technology: Improving Individual and Organizational Performance Worldwide. Jossey-Bass, Pfeiffer, 1999.
- Wedman, J., & Tessmer, M. (1991). Adapting instructional design to project circumstance: The layers of necessity model. Educational Technology, 31(7), 48-52.
- Wilson, B.G. (1999). Evolution of Learning Technologies: From Instructional Design to Performance Support to Network Systems. Educational Technology. 39 (2), 32-35.
- Wilson, B. G., Jonassen, D. H., & Cole, P. (1993). Cognitive approaches to instructional design. In G. M. Piskurich (Ed.), The ASTD handbook of instructional technology (pp. 21.1-21.22). New York: McGraw-Hill. <http://carbon.cudenver.edu/~bwilson/training.html>
- Winer, L.R., Rushby, N. & Vazquez-Abad, J. (1999). Emerging Trends in Instructional Interventions. In H.D. Stolovitch and E.J. Keeps (Ed.), Handbook of Human Performance Technology: Improving Individual and Organizational Performance Worldwide. Jossey-Bass, Pfeiffer, 1999.
- Witt, C. L., & Wager, W. (1994). A comparison of instructional systems design and electronic performance support systems design. Educational Technology, 34 (7), 20-24.



# Categorizing Exemplary Educational Websites

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## Abstract

*The number of educational sites on the World Wide Web grows daily and teachers may have difficulty identifying sites well matched to their intended outcomes for learners. This study describes the development of an instrument to categorize educational Websites. One hundred ninety-five (195) “exemplary” or award-winning educational Websites were examined and evaluated by the researchers. During the evaluation, thirteen general site categories emerged, and the sites were sorted into these categories. This paper describes the categories of the instrument, the process by which the instrument was developed, and the result of this categorization.*

The use of the World Wide Web (the Web) appears to be increasing rapidly in education, and may have already become an important resource for teaching and learning. However, the sheer number of educational sites and variety of sources can be overwhelming for educators who want to incorporate the Web in instruction. It is difficult to know which sites are good and which are not. In fact, this proliferation and the speed with which new sites appear makes it near impossible for any one teacher to examine enough sites to sift the wheat from the chaff.

To assist teachers and parents, some organizations and agencies have recognized educational sites they judge to be “exemplary.” For example, the International Academy of Digital Arts and Sciences selects the best of the Web for the annual Webby Awards (<http://www.webbyawards.com/nominees/index.html>). Similarly, each year the Education Source names their Top 100 Educational Websites ([http://www.edusource.com/articles/top100\\_99/default.asp](http://www.edusource.com/articles/top100_99/default.asp)). PC Magazine also names its annual Top 100 Websites, including an “Education and Family” category (<http://www.zdnet.com/pcmag/stories/reviews/0.6755.2394453.00.html>). Some agencies identify “exemplary” Websites more often; for example, each month the Eisenhower National Clearinghouse for Mathematics and Science Education (ENC) recognizes thirteen exemplary Websites in science and mathematics ([http://www.enc.org/classroom/dd/nf\\_ddcrit.htm](http://www.enc.org/classroom/dd/nf_ddcrit.htm)).

Examining these recognized educational Websites reveals a wide variety of purposes, strategies, audiences, and content. Our purpose in this study was to examine such recognized educational Websites and develop an instrument to categorize them based on emergent categories. This, in turn, should help show which types of sites seem most likely to be named as “exemplary.”

## Methods

A total of 218 sites were compiled from sites recognized in 2000 by the above-named recognizing groups (Webby’s, ENC, Top 100 Ed Websites, PC Magazine). When we examined those sites, seven were duplicates and sixteen were non-functional, yielding 195 functional “exemplary” educational sites.

The 195 sites examined were developed for various purposes and were diverse in target audience and content. This meant that any instrument we designed had to encompass what we found on the sites. Beginning with a proposed categorization instrument, two researchers reviewed and categorized each of the 195 sites. They then compared results, and discussed and debated at length on sites they categorized. A third researcher served as a mediator to resolve inter-rater differences. Each site was analyzed until all three members agreed on the categorization of every site. The instrument and operational definition of each category evolved during the process of evaluating the sites. That is, as we analyzed the sites and resolved our disagreements, the categories on our instrument were modified or confirmed.

Below we list 13 possible categories for Websites that emerged as the researchers evaluated the sample of “exemplary” or award-winning sites. Note, however, that not all sites can easily be placed in a single category. Some sites exhibit properties of two or more of the following categories. When classifying these sites, we identified which classification seemed most representative of the site as a whole. Sites that were equally distributed across two

or more types were noted and included in the discussion of results. The categories are presented as follows with definitions and examples of each

### **Instructional**

To be classified as instructional, a site must include (1) an intended learning outcome, (2) instructional strategies, (3) learning materials and activities, and may include (4) learner assessment and/or feedback. An instructional strategy is a pedagogical technique designed to facilitate learning through a combination of teacher and learner activity. We observed that these elements may be explicitly stated and demonstrated or they may be embedded within site content.

Instructional Websites with a constructivist-oriented design and/or self-exploratory navigation strategy usually don't include formal stated learning tasks, however. Instead, these sites usually provide learning activities that require learners to do something on the Web, including reading posted information; completing practice activities and/or playing games; exploring related resources; using a site search engine; communicating and/or sharing with peers, teachers, and/or experts; exploring, articulating, or reflecting in a problem-based learning; and creating content. Note that the learning activities in a site must go beyond just reading posted information in order to be categorized as an instructional site.

Examples of instructional sites include: *Learn Physics Today* (<http://library.advanced.org/10796>) and *Conflict Yellowstone Wolves* (<http://powayusd.sdcoe.k12.ca.us/mtr/ConflictYellowstoneWolf.htm>). *Learn Physics Today* is an online physics tutorial. *Conflict Yellowstone Wolves* require learners to analyze the Rocky Mountain Gray Wolf problem and draw their own conclusion to the question: Should the wolves in Yellowstone National Park be removed?

Sometimes a site will appear to be instructional when it is not. For example, some sites provide online quizzes and games (one form of learning activity). However, their mere presence does not guarantee that a site is instructional. When quizzes and games serve no instructional purpose and are designed primarily for entertainment, we did not classify the site as instructional. Another way in which a site can erroneously appear to be instructional is when it uses instructional labels like "tutorial" or "problem-based learning project" in referring to itself, but actually contains no instructional strategies. In other words, it is not enough simply to claim to be instructional. The key is whether the site includes the three essential instructional elements.

### **Content Collection**

A content collection site is a collection of information about a specific content area (such as genetics or insects) that is informative and might be used in learning but is not instructional. Content collection sites differ from instructional sites in that they don't provide users with learning activities, goals, strategies, or assessment. They may, however, include informative readings, illustrations and other rich content. A typical content collection site on a specific subject is *Common Cold* (<http://www.commoncold.org/>), a comprehensive source of information about the common cold. *Carol Hurst's Children's Literature Site* (<http://www.carolhurst.com/>) is an example of content collection site on a general topic. The site is a collection of reviews of great books for kids, ideas of ways to use them in the classroom and collections of books and activities about particular subjects, curricular areas, and professional topics.

### **Archive/Database/Reference**

An Archive/Database/Reference (ADR) is a collection of information that is organized as an archive. These sites may be indexed chronologically, alphabetically, or topically. Such sites are designed as information and reference tools. Online dictionaries, encyclopedias, reference books, and question-answer services comprise this category. These differ from Content Collections in that they may address multiple topics and are oriented toward searching for information rather than examining a topic. One example of an ADR sites is *American Memory* (<http://memory.loc.gov>), a site that offers more than seven million digital items from more than 100 historical collections relating to the history and culture of the United States. *Ask Jeeves for Kids* (<http://www.ajkids.com/>) and *The Last Word Science Questions and Answers* (<http://www.last-word.com/>) are representative of questions-answers service ADR sites.

### **Compilation of Online Learning Activities/Games**

These sites are collections of individual learning activities and/or games to be completed online by learners. *ExploreMath.com* (<http://www.exploremath.com/index.cfm>) is a collection of interactive math activities in 13 categories. As suggested by the site, these individual learning activities may be incorporated into the mathematics classroom, lab, or distance learning curricula, but such compilations fail to exhibit the essential three components of an instructional site.

### **Collection of Links**

Sites in this category feature listings of categorized external hyperlinks to online resources on a subject. They contain little or no content of their own and serve principally as portals to external content. European Renaissance (<http://www.execpc.com/~dboals/rena.html>) lists 67 related external links. It should be noted that if a site's collection of links are mostly internal (or most of the actual content is within the site), it should be classified as Content Collection.

### **Online Exhibit**

Online exhibits are focused collections of media (for example, images, recordings, animations, videos, VRMLs) related to some particular content or event. Displays of museum or organization holdings online are typical of this category. Such sites are designed for exhibition and information purposes. These virtual exhibits are often representations of actual museum exhibits in the physical world. For example, *Ocean Planet* ([http://seawifs.gsfc.nasa.gov/ocean\\_planet.htm](http://seawifs.gsfc.nasa.gov/ocean_planet.htm)) is an online version of than actual exhibit from the Smithsonian National Museum of Natural History.

### **Teacher Resource**

Teacher resource sites are designed to provide teachers with such things as lesson plans, classroom activities, teacher guides, curricula, state and national standards, and professional-development resources. These materials may be housed within the site or available as downloadable files. While such sites may also include subject matter links and learner activities, the main focus of the site is assisting teachers.

For example, *One Sky Many Voices* (<http://www.onesky.umich.edu/>) lists inquiry-based K-12 science curricula for use by teachers, and *Illuminations* (<http://illuminations.nctm.org/>) is designed as a teacher resource with the following components: online multimedia math investigations, classroom video vignettes, standards-based lesson plans, links to reviewed Websites, and access to the National Council of Teachers of Mathematics Principles and Standards.

### **Vicarious Participation**

Vicarious participation sites provide learners with opportunities to participate online in an ongoing educational or research activity, or an expedition. Virtual field trips are included in this classification. These sites attempt to give the learner a sense of participation in activities not available to the typical classroom student. Such sites may archive the materials from past explorations for examination any time after the activity is concluded. *The Jason Project* (<http://www.jasonproject.org/>) is an example of an ongoing educational activity. In *The Jason Project*, learners can participate in a current learning adventure and visit Jason's past expeditions. In *Extreme 2000* (<http://www.ocean.udel.edu/deepsea/>), a deep-sea research expedition, learners may view video clips of the expedition, read the dive log and daily journal, and listen to live audio from the research team.

### **Research/Curriculum Project**

These sites are designed to inform the visitor about a particular ongoing research or curriculum project. Content may include news and upcoming events, research results and publications, individuals associated with the project, funding, and other related information. For example, Rural and Urban Images (<http://www.ael.org/nsf/voices/index.htm>) is a three-year project seeking to help girls excel and feel confident in science, math, and technology.

### **Communication Community**

Communication community sites facilitate discussion, interaction, entertainment, and other information-sharing. Users can play interactive games and share thoughts and ideas with each other via e-mail, chat, and message boards. Such sites usually do not include learning activities, although they may be "educational" in the broader sense of encouraging discussion of current events and issues of importance to learners. Example sites include *Cyberkids* (<http://www.cyberkids.com/>) and *Kids Space* (<http://www.kids-space.org/>).

### Place with Public Mission

This Website classification refers to actual places such as museums, historic sites (like Mystic Seaport or Colonial Williamsburg), zoos, gardens, aquariums, parks, and the like. Such sites typically address visitor information, schedules, exhibits, “how to get here,” membership, and special events. Many of these sites include an education section with learning materials and activities for teachers and students and are often referred to under the umbrella of Informal Education. *Exploratorium* (<http://www.exploratorium.edu/index.html>) and *Colonial Williamsburg* (<http://www.history.org>) are two examples of such sites.

### Academic or Research Organization

These sites represent a particular non-commercial research organization or academic unit. They typically address such things as the nature and purpose of the organization, purpose, its current and past projects, recent results, pertinent news and events, and related educational materials and activities. *NASA* (<http://www.nasa.gov/>) and the *NASA Jet Propulsion Laboratory* (<http://www.jpl.nasa.gov>) are two examples of such sites.

### Commercial

Commercial sites are primarily intended to promote and sell products or services. Many commercial sites have ancillary components designed to inform, educate, or entertain. For example, a company selling cold and flu medicine may include information or instruction about the causes and treatments of colds and flu. It is sometimes necessary to explore a site extensively to identify whether it is commercial or not. Simply having commercial sponsorship (as might be indicated by advertising banners) is not enough. The site must have a goal of helping to promote a company’s products. One way in which some commercial sites promote their products or services subtly is by targeting young audiences using cartoon-like animation and games on their Websites. Once again, one needs to look for the commercial connection. Usually it becomes clear on close examination. Examples include *CNN Interactive* (<http://www.cnn.com>), *National Geographic Society* (<http://www.nationalgeographic.com/>), *SurfMonkey Kids Channel* (<http://www.surfmonkey.com/>) and *US Space Camp* (<http://www.spacecamp.com>).

Table 1 presents the distribution of “exemplary” sites across our classification scheme. The three categories most likely to be recognized, in order of distribution in our study, were Content Collection (26.2%), Instructional (20.5%), and Teacher Resource (11.8%). These three types of sites account for approximately six out of every ten sites recognized. This suggests how the recognizing groups defined “exemplary” and perhaps hints more directly at how they viewed educational use of the Web.

Table 1. Distribution of “Exemplary” Educational Websites Across Categories

Categories	# of Sites	%
Instructional	40	20.5%
Content collection	51	26.2%
Archive/Database/Reference	14	7.2%
Compilation of individual online learning activities/games	13	6.2%
Collection of links	13	6.2%
Online exhibit	7	3.6%
Teacher resource	23	11.8%
Vicarious participation	9	4.6%
Research/Curriculum project	2	1.0%
Communication community	2	1.0%
Places with public mission	11	5.6%
Academic or research organization	6	3.1%
Commercial	10	5.1%
Total:	195	100%

## Conclusions

We learned quickly that some sites cannot be neatly classified into a single category. We analyzed sites that could be assigned to two, three, or more categories. In dealing with such sites, we chose to make a holistic assignment based on what we deemed to be the site's principal orientation in terms of our classification scheme. For example, *NASA Is My Playground* (<http://kids.msfc.nasa.gov/>) and *Merriam-Webster Word Central* (<http://www.wordcentral.com>) contain both instruction and teacher resources. Since the majority of content was instruction, the sites were categorized as instructional sites. *Ask Jeeves for Kids* (<http://www.ajkids.com>) fits into at least three categories -- ADR, Teacher Resource, and Communication Community. Since its primary activity was searching, it was classified as an ADR site.

Although Reeves and Reeves (1998) and Wilson (1997) have suggested that constructivist design may be promising in Web-based learning environment, the "exemplary" sites examined in this study were almost exclusively objectivist in design orientation. Our results are consistent with those in a similar study conducted by Mioduser, Nachmias, Lahav, and Oren in 1998. Their study investigated 436 educational Websites in an effort to determine the current state and emerging trend in Web-based learning environment.

We found a number of Websites that perhaps overstated the extent to which they were instructional sites. For example, *Embryo Images* ([http://www.med.unc.edu/embryo\\_images/](http://www.med.unc.edu/embryo_images/)) described itself as an instructional tutorial, but is simply a slide show of images with text descriptions. Other sites included descriptions of "exploration" or "problem-based" instructional strategies, but turned out to involve nothing more than reading posted information.

The next step in our research will be to complete an analysis of the instructional design of the 40 instructional sites we identified. Our goal is to determine the major common characteristics of such recognized instructional Websites. As part of this analysis, we plan to refine and expand our current instrument's categories.

## References

- Education Source. [On-line]. Available: [http://www.edusource.com/articles/top100\\_99/default.asp](http://www.edusource.com/articles/top100_99/default.asp)
- Eisenhower National Clearinghouse for Mathematics and Science Education. [On-line]. Available: [http://www.enc.org/classroom/dd/nf\\_ddcrit.htm](http://www.enc.org/classroom/dd/nf_ddcrit.htm)
- Mioduser, D., Nachmias, R., Lahav, O., & Oren, A. (1998). *Web-based learning environments (WBLE): Current state and emerging trends*. [On-line]. Available: <http://www.tau.ac.il/~klttau/ktl/wble.html>
- PC Magazine. [On-line]. Available: <http://www.zdnet.com/pcmag/stories/reviews/0,6755,2394453,00.html>
- Reeves, T. C., & Reeves, P. C. (1997). Effective dimensions of interactive learning on the world wide web. In B. Khan (Ed.), *Web-based instruction* (pp. 59-66). Englewood Cliffs, NJ: Educational Technology.
- Webby Awards. [On-line]. Available: <http://www.webbyawards.com/nominees/index.html>
- Wilson, B. G. (1997). Reflections on constructivism and instructional design. In C. R. Dills & A. A. Romiszowski (Eds.), *Instructional development paradigms* (pp. 1-19). Englewood Cliffs, NJ: Educational Technology.

## PreK Central: “Come and Play”

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### Abstract

*PreKCentral is a web site designed to provide preschool teachers, daycare providers and families with tools to be used for the positive stimulation, development and education of young children through the available technology. This web site uses a database to hold the activities and links and web site visitors use either a predefined simple search or tailor the search for their interests. This session would provide an overview of the development of the site, the design considerations/constraints, and an overall look at the site. Other features such as a chat room, forum, kid art and links will be examined.*

### Description of the site

PreK Central is a web site designed for preschool teachers, parents of preschoolers, and caregivers. This site is based on the mission, philosophy and practices of the National Association of Education of the Young Child (NAEYC). NAEYC supports the planning and practice of guiding preschool children with activities that are developmentally age appropriate. By focusing on the needs of the child, NAEYC believes children begin to build a strong foundation to lifelong learning. The NAEYC web site can be accessed at <http://www.naeyc.org>.

PreK Central strives to provide many services to its visitors. Site visitors can search for age appropriate activities as well as participate in chats, forums, find outside links to other sites or explore our preschool art gallery. Early in the planning stages of the site, it was apparent that an underlying database was needed to provide a dynamic site incorporating structure, organization and to anticipate site growth. Each section of this site was designed with organization, content, usability and potential site growth in mind.

The development of the PreK Central (PreK) web site began in 1997 after the collaboration on two web sites. As graduate students we redesigned the web site for college of Human Resources and Education at Virginia Tech and were instructional designers for PE Central (<http://pe.central.vt.edu>.) As parents of preschoolers, we both found few sites geared toward preschool education and even fewer that offered developmentally appropriate activities for children. As instructional designers, we found that many very good sites were available on the Net, but they lacked three key elements: organization /content, a scheme for age appropriateness and appropriate use of technology. Sites from the search lacked the organization and content needed to support the site visitor. Also missing from preschool education sites was a scheme to determine an activity’s appropriateness for preschoolers. Another missing component from available sites was the appropriate and effective use of available technology. These three areas were the main focus in our site design and will be elaborated on through the site’s design process.

### Planning and constructing the site

#### Organization and content

Pre K Central was envisioned with these multiple sections: a database of activities, a chat room, a forum, a page of preschooler-related links, and the preschool art gallery. Access to these sections is designed with the audience in mind. The elements that make up the site (the navigation, layout, graphics, links and other information) should be easily understandable by any visitor to the site. Our target audience is a diverse group of visitors. The site is for teachers, parents of preschoolers and other preschool caregivers. This audience can be broken into two major groups: those who have formal training (i.e. preschool teachers) and those with no formal training. Sites with a diverse audience such as PreK Central need to be flexible and provide several avenues to obtain information. One way to design to these audiences is to begin by asking questions like, “How will different visitors use the site?” or “What information will visitors be looking for?” This technique becomes one of the driving forces in the design of the site. A detail of how those with formal training and those with informal training are addressed in our scheme for appropriate practices.

#### Site Content

The database would need to hold blocks of text, but could also be used for other forms of web media such as images (GIFs and JPEGs), sound files (MPEGs, WAV files or QuickTime movies). There is also a need to try to foresee other forms of media that may be included since web design is still in its infancy. Designers for PE Central failed to accurately predict how the site would grow. By planning for growth, hopefully Pre K Central could easily be expanded to site visitor's future needs.

After designing the database, usability testing was done by a technique we termed a 'mental walkthrough' which was a helpful tool to determine whether the logic used in the design process was sound. This also helps later when deciding whether or not to use certain elements. "Mental-walkthroughs" put designers in place of the site visitor and mentally walk through a web site. These mental walkthroughs help us, as designers, add consistency to the site. They also force designers to "think outside of the box" and really consider the site visitor. Many times web designers design a site as they would use it and force the visitor to "think like me" to get around a site.

Some questions asked for this site (with our possible solutions):

What information might I look for if I was a parent?

- Activities grouped in understandable categories
- Variety of outside links

What information might I look for if I was a teacher?

- Activities grouped by skills to build
- Variety of outside links

Is the viewer and potential viewer being considered?

- Assume the role of a potential viewer

Is an experienced visitor bored or annoyed by the searches?

- Build with enough search options
- Layout the search page so that it is easy to navigate
- Layout the site so the search is easy to find

Could I use this site if I had little experience using the Web?

- Design easy, obvious site navigation
- Provide many ways to find information

What terms are common enough for a layperson such as a parent to recognize?

- Choose terms that are intuitive as to their meaning
- Use images that help describe terms

What terms would a teacher or trained educator likely to recognize?

- Use NAEYC's terminology

How could both these groups of visitors get to the same information, easily and quickly?

- Provide many ways to find information

### Scheme for appropriate practices

PreK Central has a diverse audience: for preschool teachers, parents of preschoolers, and caregivers. As state before, the audience is made up of two major groups: those who have formal training (i.e. preschool teachers) and those with no formal training. Searching for information was a crucial part of the design of the PreK Central web site. On the surface there appears to be categories of activities and a searchable feature. These are really one the same search. The categories of activities are really defined fields in the database, a narrowed search.

Creating two different ways to search the same database solved the solution to this. For teachers and other child care professionals, a search of "kid skills" is offered. From NAEYC's standards of appropriate practices (Bredekamp, 1987) four categories of skills emerged. Named: Physical, Cognitive, Social and Emotional Skills, these "kids skills" are a set of skills that teachers would most likely be using to plan their activities. Here is the complete listing of our Kid Skills and the concept they introduce:

<b>Skill</b>	<b>Kid</b>	<b>Introduces...</b>	<b>Kid Skill</b>	<b>Introduces...</b>
Physical		large motor small motor levels of activity hand-eye coordination	Cognitive	imagination formulating hypothesis ordering critical thinking levels of complexity
Social		communication with others		addition /subtraction

Emotional	social awareness	classification
	social interaction levels	seriation
	social leader or follower	number
	social cooperation	spatial relationships
	large groups	mass and quantity
	small groups	causality
	multicultural	time concepts
	repertoire for solving social problems	spoken language
		written language
	expressing needs/feelings in appropriately	divergent thinking
	self-control	size of objects
	perseverance	balance and support of structures
	patience	space concepts
	orientation of self in world	(volume/area) relationships of objects
	concepts of self	observations
		creative thinking
		creative expression

Table 1: Kid Skills and concepts introduced.

For parents or others looking for appropriate activities a search of “kid talents” or categories that activities naturally fall into is possible. Kid talents are topics such as “Make believe” and “Arts-n-crafts”. These Kid Talents are matched to images that depict the kid talent. Here is our listing of Kid Talents with our description of what kind of activity falls into that Kid Talent.

Talents	Definition
Arts-n-crafts	Foster creativity through 2&3D art
Make Believe	Encourage imaginative play
Got Rhythm?	Introduce body movements & music
Word Play	Whole word, letter recognition, phonics
On the move	Gross motor skills
Easy as 1, 2, 3	Build math skills
Celebrate Us!	Exploration of own and other cultures, holidays and customs
Me Too!	Activities with several generations
Hands-On	Manipulative and small motor
I Wonder	Science activities
Clubhouse	Circle time, social activities
Young Explorers	Exploration outside the four walls of a classroom

Table 2: Kid Talents and their objective.

### Site Organization

The site is broken into several components that support the site visitor. These components are the database of activities, a chat room, a forum, a page to related outside links and a gallery of children’s art. Each of these supports the visitor in different ways. The activities are the most important part of the site. This section will hopefully grab the visitor’s attention and bring them back. The chat room and forum are still in their developmental stages. They are intended to begin on line discussion among teachers, parents and caregivers. The chat is a place where all can gather to trade information and ideas in real time. The forum differs in that it is more of a posting or bulletin board for discussion. Presently there are just topics listed, but it is hoped that eventually guest speakers and experts in the field of childcare and early childhood education can post their points of view. There will be available along with the opportunity for others to respond. The off site links is a collection of early childhood education links. Many topics are available from funding opportunities for preschool and preschool teachers to child advocacy links.



Overhaul of this section is being done to include a search similar to the activity search. The last section of preschool art is a fun and playful way preschools; their teachers and even parents can show off and learn from preschool art.

### **Appropriate, effective use of available technology**

Appropriate and effective use of the available technology has always been one of our concerns for PreK. Too many times a web site has the potential to be a great site but lacks function or features. This is not a lack of 'spinning and flaming logos' but in the lack of using the technology that is available. An argument may be made that you need commercial software to keep a site up, looking good and running well. We have found the opposite true and have built and maintained PreK Central with very little commercial software.

PreK was created on a "shoestring budget"; Labor was low-cost with two grad students developing in their free time. For most of the site, free "open source" software has been used to bring it online, up and running. Open source software has grown from software developers and users who find commercial software packages too limiting in features, too difficult to modify, leaving them frustrating and difficult to use. It is well maintained, updated and documented, by those who use it. PreK's server runs a free operating system (OS) called RedHat Linux (<http://www.redhat.com/>). The web server is Apache (<http://www.apache.org/>), which is also free. The database that holds the activities and links is MySQL (<http://www.mysql.com/>). Even the scripting language, PHP (<http://www.php.net>), used to pull from the database is free. The chat and forum software that we use are also open source projects.

### **Define look & feel**

The "look and feel" of this web site was very important. Early in the design process, a childlike theme was chosen for the site. This playful design was meant to encourage even visitors new to the web pages to "come and play". Fitting to the theme, a "childlike handwriting" font and adopting a "crayon colors" color scheme throughout the site. Images for the site were based on simple sketches, drawings and designs created with the help of a two-year-old boy. This became part of the design process and led to color and playfulness as a major theme. This worked well with the subject matter, the navigation and the search method.

From the database and search design, the site had to be easy to navigate, easy to use and easy to find information. With the incorporation of a database, the site could easily be designed with only three or four pages. Search and results pages could be reused, since every search was not a static page. This adds to the consistency of the "look and feel" since visitors become accustomed to seeing one page.

### **Adding Depth**

The next steps to the growth of this web site are to add depth to the site. Plans for this are underway to continue to add more activities, add an easier way for viewers to submit their ideas and to develop the chat room and forum section of the site.

Also in the works is the development of a 'community of users'. The plan is to start locally with local Virginia residents and to spread out to include others in a more virtual community. Hopefully, by adding depth to the Forum to include guest speakers will grow to virtual discussion and seminars. There are also plans to start and widen the collection for viewers to access and educate themselves.

### **Contacts**

You can visit PreK Central at <http://prek.dhs.org/> and see our selection of activities. The email address is [admin@prek.dhs.org](mailto:admin@prek.dhs.org) and a listserv at <http://prek.dhs.org/mailman/listinfo/prek-announce>. This paper can also be downloaded from <http://prek.dhs.org/AECT/>.

### **References**

Bredekamp, S. (1987). *Developmentally appropriate practice in early childhood programs serving children from birth through 8*. (Expanded Edition). Washington D.C. The National Association for the Education of Young Children.

## **Improving Visual Recognition Skills with a Digital Image Bank: the medium makes a difference.**

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### **Abstract:**

*Digital retinal photos were obtained for all first year optometry students at our College of Optometry. The catalog of digital images was utilized in several ways in print and on the web to enhance the development of critical observation and recognition skills needed for examination of the human retina. The use of digital images increased opportunities for practice and feedback resulting in improved performance compared to baseline and to students who had trained previously without using the digital image reference bank.*

### **Problem:**

Learning to examine the human retina involves the development of two skill sets: 1) utilizing ophthalmic diagnostic instruments, and 2) interpreting what is observed with them. Training in retinal examination skills (ophthalmoscopy) begins in the first semester of the professional curriculum at the Michigan College of Optometry. A typical entry-level instructional sequence involves lectures on retinal anatomy and features, and on instrumentation and techniques for observation. This is followed by supervised practice in the laboratory. Students examine each other's eyes, observing, identifying and documenting variations in the retinal appearance. Students make judgments with respect to critical features of the retina and have these verified by the instructor. Previously, the rate of progress has been hampered by several factors:

1. Observation time was duplicated because instructors had to examine the retina first before they could comment on the students' observations.
2. Instructors had to spend time looking for specific illustrative examples within the class.
3. Practice opportunities outside of scheduled class time provided no feedback or verification by the instructor.
4. Opportunities to formally assess students' accuracy in observation were limited.

### **Methods:**

The availability of digital ophthalmic photography and web course management software presented a unique opportunity to converge these technologies to enhance training and performance of retinal examination skills.

The first phase of the project involved an analysis of feasibility, methods, materials and cost. An estimate of image acquisition and processing time per subject was determined. Images would be used for both screen viewing and print viewing; therefore, various papers and printer settings were compared for print quality. Estimates of production time and costs for the print versions of the image catalog were determined. Then the images were acquired using the Digivid® retinal video capture system by Helioasis. The software allows the images to be exported in either TIFF or JPEG graphic file formats for utilization outside of the Digivid database. Each of the 68 images was exported and saved in the JPEG format immediately after capture and verification that the captured image was acceptable.

The next phase involved measurement of baseline observational skill level prior to any instruction on ophthalmoscopy and retinal features. First year students were pre-tested via a time-limited, WebCT-delivered and auto-graded visual matching quiz in October of 2000. Ten test images were selected from the acquired image bank and uploaded to the WebCT course. Each of the 10 images was inserted into a short answer question format using WebCT's quiz tool. The student task was to compare each image to a selection of 40 print images assembled and numbered in an accompanying catalog. The student answered by typing in the number of the image they chose as representing an exact match. The question stem advised the student that if a matching image was not found, a response of "0" should be entered. This assured that all 40 images had to be considered before an elimination could

be made. A ratio of 10 test images to 40 potential matches and a time limit of 15 minutes were judged to constitute a reasonably rigorous test of pre-instruction observational skills. Questions were presented one at a time, and could not be revisited once answered or skipped.

During the next three weeks, entry-level instruction and practice in the techniques took place. Instruction was enhanced by utilization of the acquired image bank in several ways. Instructors had “key” copies of the class’ retinal image catalog printed with the photos identified by name. This enabled quicker awareness of pertinent features of each eye in the class, and more effective guidance of the student’s interpretation of his or her observations. This could be done without the instructor duplicating the physical examination process. Furthermore, each student was provided a copy of the class’ image catalog printed *without* identifying the photos by name. Similar to the pre-test task, now the students were to compare direct observations of their classmates’ retinas to the print images and identify each image by name. In this process, they had to pay close attention to minute details that differentiated similar images from one another. The student received immediate affirming or corrective feedback from the instructor. With much repeated practice, retinal details are identified with greater speed and accuracy. To provide additional practice opportunities outside of scheduled laboratory sessions, the entire class image bank was uploaded to the WebCT course and placed within WebCT’s image database tool. These on-line images were identified by name, so that the students could continue their matching exercise by viewing and comparing the screen images to their as yet unidentified print images.

To assess progress from baseline, a time-limited post-test was administered with WebCT in December, 2000. Though the format was the same for this test, previously unseen retinal images were used for all questions and for the printed catalog of potential matches.

In order to compare performance to a control group, the same pre- and post-tests were also administered to second year optometry students, who had trained the prior year without the availability of such an image bank. To assess retention of skill and the impact of this technique, yet another matching test, based on a newly acquired image set, was administered to the experimental group in the Fall of 2001, when they were at the same point in training and experience as their predecessors.

### Results:

	Exp. Pre-Test	Exp. Post-test	Control Pre-test	Control Post-test	Exp. Re-test
Date	October, 2000	December, 2000	October, 2000	December, 2000	September, 2001
N	33	34	17	15	26
Mean Score	84.5%	90.9%	85.9%	84.7%	91.2%
s.d.	13.7	11.4	11.8	20.3	13.1
Mean Time	10:05	10:21	8:30	9:46	10:08
s.d.	2:28	2:12	3:00	2:29	2:41

The Wilcoxon signed ranks test was used to determine whether the distribution of the scores differed for several comparisons. Post-test scores of the experimental group showed a significant improvement when compared to their pre-test scores ( $p=.006$ ). Post-test scores for second year students showed no significant differences from their pre-test scores. The experimental group’s third test in September, 2001 showed a significant difference when compared to their pre-test scores of a year prior ( $p=.020$ ), and no significant difference when compared to their post-test scores of December, 2000. Comparisons included only those students who had completed all tests for their group. The smaller number of scores in the control group did not enable valid inter-group comparisons to be calculated. The WebCT quiz tool enables analysis of time elapsed per question, and time elapsed overall. Though there were measured intra- and inter-group time differences among the several test administrations, none of the time differences were found to be statistically significant.

### Discussion:

The results suggest that using the retinal image catalog in print and on the web heightened the experimental group’s attention to detail. While it could be argued that familiarity with the test format on the second administration may have improved scores (“learning effect”), this seems discounted by the fact that the control group showed no significant change in their pre- and post-test scores. The retention of improved discrimination skill was confirmed on

re-test of the experimental group in September, 2001. Having all the images in a tangible, readily accessible format provided more teaching and learning opportunities. They saw more eyes. They had more practice. The medium improved the efficiency of their learning. We are continuing the process with our current first year class.

# Motivation Power: Exciting Kids About Research

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## Introduction

Information literacy, the ability to find, select, organize, use, manage, evaluate, and present information, is a critical literacy for the 21<sup>st</sup> century. In a society dominated (and often overwhelmed) by information in a multitude of formats (e.g. video, audio, text, graphics), a major challenge in education is to teach our nation's youth to "be able to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information" (American Library Association, 1989, p.1).

To be information literate is to be "an effective user of ideas and information," according to *Information Power: Building Partnerships for Learning*, the professional guidelines for the school library field (AASL/AECT, p. 6). Education goals on both the national and state levels specify the importance of students' ability to use information to solve problems, make decisions and develop skills for lifelong learning.

## Information Literacy Models

In the past 15 years, a number of information literacy models have been developed to describe the skills needed to successfully conduct research and solve information problems. For example, Eisenberg and Berkowitz's Big Six<sup>®</sup> Approach to Information Problem-Solving (1990) specifies a general approach to the information problem solving process consisting of six major steps. The Big Six Approach begins with defining the parameters of the information task or problem and ends with evaluating both the results of the process and the process itself. Stripling and Pitts' Research Process Model (1988) follows a more linear approach to research, a ten-step process interspersed with eight "reflection points" that allow students to evaluate and revise or repeat completed steps where needed.

Kuhlthau's Model of the Search Process (e.g. 1993) uses the results of several years of research to describe the six stages that students undergo during the research process. She found that, rather than a neat and sequential set of skills, it is a learning process that can be somewhat messy and more iterative in nature. She also found that there are both cognitive and affective aspects to the information seeking process. For example, students frequently explore and collect information before they have done an adequate job of formulating and narrowing their topic.

All of these models are useful and share a common framework that we have synthesized into eight major categories of information skills, each with a set of sub-skills, sequenced across three broad research stages (see Fig. 1). The format of this list is not intended to imply a lockstep linear process but, in actuality, represents an iterative process in which any or all skills may be revisited in order to modify or expand on previous ones.

## Beginning Stage

### Definition

- Identifies requirements of research task.
- Determines amount/type of information needed to complete research task.
- Considers potential topics.

### Selection

- Narrows topic to be explored.
- Specifies subtopics or related keywords.

### Planning

- Formulates a search strategy.
- Identifies potential information sources.
- Creates a general framework for organizing information found.
- Identifies potential formats for presenting results.

## **During Stage**

### Exploration

- Uses indexes and search engines.
- Locates and accesses information resources.
- Explores range of information resources.
- Rethinks research topic.
- Finalizes formulation of research topic.

### Collection

- Selects most appropriate information sources.
- Skims/scans information sources.
- Locates relevant information within selected sources.
- Identifies and extracts relevant information from selected sources.
- Uses highlighting and/or note-taking skills.
- Evaluates quality of information and information source.
- Recognizes when sufficient information has been obtained.
- Stores information for potential future use.

### Organization

- Analyzes quality of information.
- Filters out irrelevant information.
- Summarizes/synthesizes/classifies final information.
- Sequences final information.
- Organizes final information for presentation

## **Ending Stage**

### Presentation

- Selects most appropriate format for communicating results.
- Assembles organized information for presentation.
- Reviews presentation for grammatical, spelling, and other errors.
- Cites sources appropriately.
- Presents results.

### Evaluation

- Evaluates end product.
- Assesses the efficiency of the research process.
- Determines ways to improve future research process and results.
- Determines future usefulness/applicability of research process.

## **The Power of Motivation**

Through her landmark longitudinal research in which she observed students as they completed a research task, Kuhlthau (e.g., 1991, 1993) identified not only the cognitive strategies students used but also the affective feelings that students experienced at various stages in the research process. For example, she found that during the Beginning and During Stages, when students try to identify a research topic and again as they begin to explore and collect information on their topic from information sources, they often experience feelings of anxiety, uncertainty and information overload and are more likely to become discouraged and demonstrate low confidence. She reports that it is not until about midway through the process that students begin to resolve this uncertainty, formulate a more precise research topic and search strategy, and feel more confident and self-determining.

In a study exploring the motivational strategies used by school library media specialists when teaching information literacy skills to students, Small (1999) used the ARCS Model to analyze and describe her findings. She found that while library media specialists incorporated many motivational strategies into their instruction, the majority of those strategies were Attention strategies, with very few Relevance, Confidence, and Satisfaction strategies. Kuhlthau's work, however, indicates a need to emphasize Relevance and Confidence strategies at certain

critical points as students proceed through the research process. While current information literacy models do a good job of defining the appropriate concepts and skills to be taught (i.e., describing *what* to teach), they all lack a systematic approach for applying motivational principles to the design of information literacy skills instruction (i.e., prescribing *how* to teach in a way that stimulates intellectual curiosity, encourages continued information seeking, and promotes a desire for lifelong learning and exploration). To help fill this gap, we have developed a way to enhance existing information literacy models with an *overlay* of motivational techniques and strategies.

The Motivation Overlay for Information Skills Instruction (Small & Arnone, 2000) integrates several theories and models in information science and motivation, especially the work of Kuhlthau (e.g., 1993) and Keller (e.g. 1987) to present a framework for designing motivating information literacy skills instruction (see Fig. 2). It is called an overlay because it is meant to be superimposed on any existing information skills model in order to guide the creation or selection of motivational techniques for information skills lessons.

The Motivation Overlay for Information Literacy Instruction promotes an *information motivation* perspective that excites students about information exploration and knowledge discovery and encourages self-determination and self-efficacy in the development of information literacy competence for lifelong learning. “The Motivation Overlay prescribes an SOS (situation-outcomes-strategies) framework for creating challenging, student-centered, information-rich learning environments that (1) take into account the motivational *situation*, including the incoming motivational profile (attitudes and motives) of students, (2) target desired motivational *outcomes*, and (3) suggest broad motivational techniques and specific *strategies* to engage learners in and excite them about the process of constructing meaningful knowledge and developing skills in order to solve authentic information problems” (Small & Arnone, 2000, p. 23).

The Motivation Overlay for Information Skills Instruction specifies motivational goals to guide the design of information literacy skills instruction and selection of motivational techniques and strategies for each of the research stages. Motivational goals differ from instructional goals in that the former describe general feelings, attitudes, and motives to be achieved during instruction while the latter are broad statements to describe the intended learning results of that instruction. Specification of motivational goals is a necessary prerequisite to the selection (and later evaluation) of effective motivational techniques.

Based on what we know from Kuhlthau’s research, at the beginning of the research process when students are required to define their research task, select and narrow their research topic, and plan their research strategy, motivational goals should lead to an instructional design that (1) generates student interest in the research process; (2) helps students recognize the importance of learning information literacy skills; and (3) builds students’ confidence in their ability to successfully conduct research tasks. During the research process, as students explore, gather, and organize information, motivational goals should focus on (1) maintaining students’ interest in the research process; (2) promoting continued valuing of learning information literacy skills; and (3) reinforcing students’ confidence in their research ability. As students proceed through the concluding stage of the process in which their research results must be presented and evaluated, motivational goals should emphasize (1) encouraging students’ ongoing confidence in their research ability; (2) promoting students’ satisfaction in their research accomplishments; and (3) motivating students’ continuing information exploration. The underlying motivation theories for each of these stages are also specified. (For a complete description of these theories and their relation to the Motivation Overlay for Information Skills Instruction, see Small & Arnone, 2000).

<b>Research Stages</b>	<b>BEGINNING</b>	<b>DURING</b>	<b>ENDING</b>
<b>Information Skills</b>	Definition Selection Planning	Exploration Collection Organization	Presentation Evaluation
<b>Motivational Goals</b>	Generate interest in the research process.  Establish importance of information skills.  Build confidence in research ability.	Maintain interest in the research process.  Promote value of information skills.  Reinforce confidence in research ability.	Encourage ongoing confidence in research ability.  Promote satisfaction in research accomplishments.  Motivate continuing information exploration.
<b>Related Motivational Theories</b>	Expectancy-value Need	Expectancy-value Need	Expectancy-value Attribution

	Curiosity Attribution Social learning	Flow Attribution Social learning	Curiosity Social learning
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Fig. 2. The Motivation Overlay for Information Skills Instruction

Each of the motivational goals may then be used to guide the design of a “Motivation Toolkit,” a set of motivational techniques and strategies for accomplishing a particular goal. One technique and an example strategy for each of the research stages is presented in Figure 3. (For complete toolkits for all three research stages, see Small & Arnone, 2000, pp. 66, 109, and 146).

## Motivation Toolkit




<p><b>BEGINNING STAGE</b> <i>Motivational Goal</i> Generate interest in research process problem to explore.</p>	<p><i>Technique</i> by stimulating curiosity.</p>	<p><i>Example Strategy</i> Pose a perplexing research question or</p>	
<p><b>DURING STAGE</b> <i>Motivational Goal</i> Reinforce confidence in research ability</p>	<p><i>Technique</i> by maintaining an atmosphere of acceptance.</p>	<p><i>Example Strategy</i> Provide practice with feedback in using online databases.</p>	
<p><b>ENDING STAGE</b> <i>Motivational Goal</i> Encourage ongoing confidence in research ability.</p>	<p><i>Technique</i> by providing enrichment opportunities.</p>	<p><i>Example Strategy</i> Introduce students to more advanced research tools and materials.</p>	

Fig. 3. Example of a Motivation Toolkit (adapted from Moyer & Small, 2001).

Each Motivation Toolkit can be customized to meet the motivational needs of a particular lesson. In addition, each Toolkit can be expanded and updated over time. The creation and use of Motivation Toolkits will enhance the teaching and learning of information literacy skills for all students.

**References**

American Association of School Librarians & Association for Education Communication and Technology. (1998). *Information Power: Building Partnerships for Learning*. Chicago: American Library Association.

American Library Association, Presidential Committee on Information Literacy. Final report. Chicago (1989). (ED 316 074)



- Eisenberg, Michael E. and Robert E. Berkowitz. *Information Problem-Solving: The Big Six Skills Approach to Library and Information Skills Instruction*. Norwood, NJ: Ablex, 1990.
- Keller, John M. "The Systematic Process of Motivational Design." *Performance & Instruction* (1987): 1-8.
- Kuhlthau, Carol. "Inside the Search Process: Information Seeking from the User's Perspective." *Journal of the American Society of Information Science* 42, no. 5 (1991): 361-371.
- Kuhlthau, Carol. "Implementing a Process Approach to Information Skills: A Study Identifying Indicators of Success in Library Media Programs." *School Library Media Quarterly* 22, no.1 (1993): 11-18.
- Moyer, S. and Small, R.V. (2001, Jan-Feb). Building a "Motivation Toolkit" for Teaching Information Literacy. *Knowledge Quest*, 29(3).
- Small, R.V. (1999, Jan.). Motivational strategies in library and information skills instruction: An exploratory study. *School Library Media Research* (<http://www.ala.org/aasl/SLMR/index.html>).
- Small, R.V. and Arnone, M.P. (2000). "Turning Kids On to Research: The Power of Motivation," Englewood, CO: Libraries Unlimited, 2000.
- Stripling, Barbara K. and Judy M. Pitts. *Brainstorms and Blueprints*. Englewood, CO: Libraries Unlimited, 1988.

# Issues In Integrating Computers Into Classroom

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## Abstract

*The technology adaptation is a very complex process. This process includes many different components or variables such as quality of technology teacher training, quality of hardware and software, strategies and alternative ways of infusing software into lessons and effectiveness of class organization (District of Columbia, 1992). In this paper, I will discuss computers and computer-related issues in the classroom. This paper specifically focuses on the following issues:*

- *How technology/computers is integrated in the classroom*
- *How it changes teachers' classroom practices*
- *What determines students' attitudes toward technology*

## Computer Integration

Computers have been in schools for a long time. While some teachers have integrated them into the curriculum successfully, some others have not used it at all. The following three issues can be considered important in integrating computers in the classroom: what roles do computers play in classroom? To what extent do teachers employ them to teach? And what are the specific procures and models followed to integrate computers in the classroom?

## Roles of Computers in the Classroom

Computers have different roles and functions in the classroom. Seven major uses of computers in education have been discussed in the literature: drill-and-practice, tutorial, problem solving, simulation, inquiry, testing and programming. In the drill-and-practice, students are introduced new concepts and skills, and then computer gives practice in using them. A Spanish teacher, for example, may spend one lesson explaining the use of the imperfect tense, and for the next lesson may design a computerized practice in handling this tense.

In the tutorial, computer introduces and explains concepts and skills in which it gives practices. Similar to the programmed instructional text and teaching machines, the tutorial presents informational frames and also asks questions about them. In the problem solving, students are expected to solve problems posed by the computer. The computer structures the problems in a way that students identify the solution step by step and at the end of each successful step the computer provides scheduled rewards. Students' behaviors are shaped towards thinking about and tackling with problem solving.

In the simulation, students confront an environment that operates under certain rules. Their role is to act within this environment and then observe the results. For example, in a geography course, students can create their own trip across the Atlantic and make adjustments along the way accounting changes in wind and currents. Students also may use computers to retrieve information from diskettes, CDs, remote data sources to reach information from books and periodicals or the product of electronic publications that appear in no other form. The most common application of the computers' inquiry function would be searching the World Wide Web pages to gather data to solve a problem.

Computers are also ideal for presenting and scoring tests. They can automatically adjust the difficulty levels of test items based on students' responses so that students' performances are measured more precisely in less time. On the other hand, computers are able to improve students' learning performance by providing instant feedback based on students' answers. Computers are programmable tools. There are sets of instructions written one of several codes called programming languages. Although students need to know how to program to benefit from

computer technology, gaining such a skill gives them greater control of the medium and opens opportunities for later employment.

### **Teachers' Level of Computer Use**

It should not be expected from every teacher to use the technology at the same level because of the differences in their enthusiasm, knowledge and competencies. Hardy (1998) describes five different types of teachers using technology at different levels. The first type, enthusiastic beginners, prefers very basic computer applications to support their direct instruction. The second type, supported integrators, employs computers for the following purposes: enabling students to create their own products and helping them demonstrate their skills and ideas during the class. Supported integrators use varieties of computer programs and allow students explore those programs by themselves. High school naturals are concentrating on quantitative and analytic functions of computers and they mostly use computers' programming function. Unsupported achievers employ computers for remediation and they do not make much use of sophisticated applications. Finally, struggling aspires make very limited use of computers for their direct instruction.

Moersch (1995) describes seven levels of computer uses in the classroom. At the first level use teachers do not use any electronic technology. The technology they use is text-based, such as chalkboard and overhead projector. In the second level, teachers do not use computers directly in the classroom. Students use computers outside of class to perform some tasks, such as writing papers with word processors and creating data sheets with spreadsheet software. In this case, there is very little relevance to the teachers' instructional activities. The third level application is using computers as a supplementary tool. Tutorial, game or simulation programs are used to extent class activities or provide enrichment. In the infusion level, which is the fourth level, varieties of software programs are used, such as databases, graphing packages and multimedia applications in classroom. However, those applications are isolated from instructional events. For example, communication tools are used among people to only share data rather than actual teaching and learning. The forth level of use are more teaching and learning oriented. Computers are used for presenting information in a meaningful way to students so that students are put in a real-like environment for authentic learning. At the expansion stage, technology goes beyond classroom. Students use computers outside of class to perform lesson-related tasks. The final stage is refinement. In this stage, the problems are authentic. The computer is the major medium to search and process data for the problems and to bring the authentic solutions.

### **Planning the Integration**

The use of computers in classroom should be carefully planned for successful implementations (Grangennet et al., 1997). The literature describes several systematic and non-systematic instructional planning models for teachers to create technology-integrated lessons.

Guide (1989) indicates that in a technology planning process teachers should first identify the content of a lesson, goals and objectives of the lesson, and learning activities with computers. Once those are identified, the lesson should be planned at four levels: Introduction, information presentation, guided practice and closure. In the introduction, students should be motivated through discussing the topic and relevant experiences, and posing attention-getting questions. During the introduction, the computer can be employed to present graphical data to initiate the discussion, record the points and interesting views elicited during the discussion. Also, computer printouts can be provided with students to make them ready for the following activities. In the information presentation, students are confronted the knowledge, skills and competencies to be learned. Usually, computers are used to present those skills to students directly or help students manipulate the new information. For instance, students may use a tutorial software program because these programs explain information to be learned step-by-step. Guided practice is structured to provide independent practice to reinforce students' newly learned skills and knowledge. For example, drill and practice software can be used after learners understand how to solve certain mathematical problems. In closure, teachers should summarize the lesson and mention how students may use their new skills to solve real life problems. Presentation or simulation software would be appropriate for this stage.

Another framework for technology integration is NTeQ (integrating technology for inquiry) that provides a guideline to create a computer-integrated educational environment through solving meaningful problems. According to NTeQ framework, to plan a lesson, the following steps should be taken: specifying objectives, matching the objectives to computer functions, specifying a problem, planning the data manipulation, planning the presenting of results, planning student activities and planning evaluation. At the first phase, specifying objectives, teachers are supposed to cover all the skills students need to gain during the lesson or unit. Then, teachers evaluate each

objective and match them with one or more functions of specific software programs. The functions are the tasks that software can do, such as calculation, drawing, matching and searching. After that, teachers create realistic problems. The problems are necessary because they will create an environment where students will generate critical thinking skills and gain necessary knowledge to reach the objectives. Also, teachers should consider how students would collect data related to the problems. They may identify a potential use of computers in data collection. Planning the data manipulation is related to how students will use the computers or what functions of computers they will employ to solve the problems. After students solve the problems with computers teachers should determine in what format students would present the results. Different presentation formats may help students see the results from different critical perspectives that would help make appropriate conclusion. The next step is planning student activities. Teachers should figure out what kind of activities would be better for students to solve the problems. The activities can either involve computer use or other classical applications, such as discussion and lecturing. The final stage is evaluation. Teachers should consider wide varieties of evaluation techniques, such as paper-and-pencil tests, a rubric and journal (Lowther & Morrison, 1998)

Sia (1992) says that, “when a teacher utilizes software to enhance instruction in a specific subject, he/she is putting software infusion into practice.” The purpose of the software infusion is to achieve predetermined lesson objectives by incorporating appropriate computer programs. The followings should be considered in software infusion. Curriculum and software objectives should be aligned. Computer programs should be used wherever they may make contribution to the purpose of a lesson. Teachers should not intend to teach a whole lesson by a single software program. Rather, they should consider using wide range of software applications with their unique contributions to curriculum during a lesson. Teachers should not see technology integration very complicated and narrow their view about the utilization of the computer. For instance, besides using chalkboard, they may use a word-processing program to help students learn complex writing skills.

New technologies that can be used for educational purposes may require new planning and integration strategies. Internet is diffusing into education very quickly. Several internet-based lesson templates have been created for effective teaching. The WebQuest is a web-supported lesson template composed of five sections: Introduction, task, resources, evaluation and conclusion. The purpose of introduction is to orient learners about what they will learn and gain their attention. The task section describes what student will be doing during the lesson. The resources have a list of pre-selected web pages that have resources to help learners accomplish the task. However, when needed, students may use resources other than the provided web pages, such as books, tapes and face-to-face interaction. In the evaluation section, the teacher explains students how they will be evaluated on the task they have to accomplish. The final section, conclusion, summarizes the experience and generalizes what was learned.

### **Technology, Teacher and Classroom**

Technology has changed the teachers’ traditional role and expectations in the classroom. Hardley and Sheingold (1993) indicate that with technology, classrooms have been changed from a teacher-centered educational environment to a student-centered environment. Teachers see themselves as learning facilitators or tutor providing students with help when they encounter problems in the learning process rather than as an expert who performs direct teaching. Students work more actively on their own within small groups in a collaborative way (Schofield, 1995).

Berg et al. (1999) observed that exemplary computer-using teachers employ technology in their classrooms in a manner that are overwhelmingly constructivist. On the other hand, students use technology as a tool to explore new information and create new products. Because student groups work independently in classroom teachers generate more time to deal with students’ individual problems and provide more learning materials for them so that they may be able to learn and think more. Moersch (1995) states that “As teachers advance from one step to another step [improves their technology use step-by-step] instructional focus shifts from being teacher centered to learner centered. The computer technology is employed as a tool that supports and extends students’ understanding of pertinent concepts, processes and themes involved when using databases, telecommunication, multimedia, spreadsheets and graphing applications. Traditional verbal activities are gradually replaced by authentic hands-on inquiry related to a problem, issue or theme.”

### **Student Attitude and Anxiety towards Computers**

There are two important issues that may affect the success of technology infusion in classroom: students’ attitude toward and anxiety about computers. Computer attitude can be defined as an evaluative disposition towards computers. On the other hand, computer anxiety is a fear or aversive behavior that occurs when students use

computers. Computer attitude and anxiety are among the major factors relating to students' success in learning (Lui & Johnson, 1998). Moreover, anxiety affects "the ability of individuals to use computers" (Anderson et al., 1984) and cause physical symptoms and discomfort (Ayersman, 1996). Due to their importance, the constructs of computer attitude and anxiety occupy a significant place in the literature (Lui & Johnson, 1998).

Two factors are considered important in computer attitude and anxiety: gender and experience. Investigating the relationship between gender and computer attitude, research studies revealed inconsistent results. Nelson and Cooper (1997) indicate that there is no significant attitudinal difference between boys and girls towards computers. However, girls use computer less than boys do and see themselves less skillful. Male students show better attitude toward computers than female students do. When programming is concerned there is a marked attitudinal difference toward computers between boys and girls in the favor of boys. Sacks et al. (1994) indicated that differences in findings may be due to instability in girls' attitude about computer across time. Also, another important finding is that boys provide unstable attribution to their failure but girls provide unstable attribution to their success.

Also, studies investigating the relationship between gender and anxiety revealed inconsistent results. McInerney et al. (1994) indicates that in using computer equipment and dealing with computer instructions males are less anxious than females and boys are more relaxed than. Chuna's et al. (1999) extended study revealed that female undergraduates are more anxious than male university undergraduates when they use the computer. In the contrary, the study by Anderson et al (1984) do not support the previous findings, which is that women in general exhibit higher levels of computer anxiety than man. Maurer (1994) took a different approach to the gender issue. Regardless of the gender, he described students with different identity as feminine, masculine, androgynous and undifferentiated. The results showed that feminine identity students had more computer anxiety than did masculine identity students regardless of gender.

Positive relationship has been found between computer experience and attitude- the more computer experience students have the higher attitude they show toward the computer (Levine & Donita, 1998). It was also found that computer experience might diminish the attitudinal difference between males and females. After having had the experience, female students exhibit better attitude toward computers. However, Maurer (1994) advocates that there is a controversy in the literature about experience. Not always experience brings high attitude. He says that computer attitude is related to the types of computer experiences or computer education students have. On the other hand, Ayersman (1996) indicates that any positive computer experience may reduce the computer anxiety, including workshops, classes, hands-on experiences and training. Even having experience with a privately owned computer at home improves students' attitude.

In addition to experience and gender, other variables are affective on computer attitude and anxiety. In science and math related areas, students experience attitude and anxiety-related problems (Sacks et al., 1994). Teacher attitude also affects student attitude in the classroom. (Dupagne & Krendl, 1992). If students are in a self-directed learning environment which is free of evaluation and assessment they have better attitude and show less anxiety toward computer than the otherwise (McInerney, 1994). Finally, access to computer determines students' attitude toward computers (Lui & Johnson, 1998). "Studies have showed that females are less likely to use computers if they have to compete for use time" (Sacks et al., 1994).

## References

- Anderson, R. E., Welch, W. W. & Harris, L. J. (1984). Inequities in opportunities for computer literacy. *The computing teacher*, 11(8), 10-12
- Ayersman, D. J. (1996). Effects of computer instruction, learning style, gender, and experience on computer anxiety. *Computers in the Schools*, 12(4), 15-30
- Berg, S. et al. (1999). Exemplary technology use in elementary classrooms. *Journal of Research on Computing in Education*, 31(2), 111-122
- Building Blocks of a WebQuest (----). Available online  
<http://edweb.sdsu.edu/people/bdodge/webquest/buildingblocks.html>
- Chuna, S. Et al. (1999) Computer anxiety and its correlates. A meta-analysis. *Computer in Human Behavior*, 15, 609-623
- District of Columbia (1992). Learning technologies essential for educational change. (ERIC Document Reproduction Service ED349967)
- Dupagne, M. & Krendl, K. A. (1992). Teachers' attitude toward computers: A review of the literature. *Journal of Research on Computing in Education*, 24(3), 420-429
- Grandgenett, et al. (1997). Integrating technology into teaching and learning: The tree keys to the kingdom. *ISTE*, 34, 252-257

- Hadley, M., & Sheingold, K. (1993). Commonalities and distinctive patterns in teachers' integration of computers. *American Journal of Education*, 101, 261-
- Hardy, J. V. (1998). Teacher attitudes toward and knowledge of computer technology. *Computers in the Schools*, 14(3/4), 119-136
- Levine, T., & Donita, S. (1998). Computer use, confidence, attitudes, and knowledge. *Computers in Human Behavior*, 14(1), 125-147
- Lowther, D. L., & Morrison, G. R. (1998). The NTeQ model. A framework for technology integration. *Techtrends*, (March, 1998), p.33-38
- Lui, L. & Johnson, D. L. (1998). A computer achievement model: Computer attitude and computer achievement. *Computer in the Schools*, 14(3/4), 33-53
- McInerney, et al. (1994) Student teachers' computer anxiety and computer experience. *Journal of Educational Computing Research*, 11(1), 27-50
- Moersch, C. (1995). Levels of technology implementation: A framework for measuring classroom technology use. *Learning and Leading with Technology*, 23(3), p.40-42
- Nelson, L. J., & Cooper, J. (1997). Gender differences in children's reaction to success and failure with computer. *Computer in Human Behavior*, 13(2), 247-267
- Polin, L. (1992). (Making) Changes in teachers' understanding and use of technology for instruction. (ERIC Document Reproduction Service ED349958)
- Sacks, C. H. et al (1994) Attitudes toward computers and computer use: The issue of gender. *Journal of Research on Computing in Education*, 26(2), 256-269
- Schofield, J. W. (1995) Computers and classroom culture. Cambridge University Press: New York.
- Sia, A. P. (1992) Enhancing instruction through software infusion. (ERIC Document Reproduction Service ED363605)
- Technology Use Guide (1989) Planning computer lessons. (ERIC Document Reproduction Service ED339258)

# Technology Explosion and Its Impact on Education

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## Abstract

*We are in the computer age and the federal and local governments have invested significant amount of money to purchase computers for schools. The average computer to student ratio has significantly increased. In the meantime, educational technologists have started questioning the effectiveness of computers in teaching and learning. The purpose of this paper is to investigate advantages and disadvantages of using technology in education and to identify the environmental (extrinsic) and personal (intrinsic) factors that cause schoolteachers and university professors unwillingness and lack of enthusiasm to implement technology in the classroom.*

## Introduction

Technology has a long history in education. Even though it has been accepted that the first educational technology endeavors started at the end of the 1800s with the school museums, the technology widely started being used after film, radio and television entered in the vision around the 1920s. Public schools modified their programs to some extent, such as rearranging class schedules, to infuse those technological innovations into the school system (Cuban, 1985). However, schools came across several problems including cost of films, insufficient hardware, awkward scheduling of broadcasts and inadequate teacher training. Moreover, the technological innovations at that time did not bring a new educational perspective. For instance, TVs were used as an accessory and substituted by teachers' lectures rather than as an essential instructional tool. Eventually, they disappear from schools very rapidly.

Now we are in the computer age and the federal and local governments have invested significant amount of money to purchase computers for schools. The average computer student ratio significantly increased. In the meantime, educational technologists have started questioning the effectiveness of computers in teaching and learning. The effectiveness of computers is still an issue and a consensus has not been provided among the researchers. However, the computers, as opposed to the other technologies such as TV and radio, have significantly impacted education from several perspectives. It has changed the teachers' role, the school curriculum and the educational research perspective.

The current studies illustrate that the teachers who are successfully employing the computers change their classical roles in the classroom, which are organizing, presenting and evaluating information. They prefer to become a mentor directing and motivating students to create questions, explore and manipulate information, and create solutions for the questions by themselves. They use more student-centered teaching approach and promote self-directed learning. Aligned with this approach, the curriculum has been modified to accommodate more problem-solving activities (Diem, 1996).

The potentials of computers have shifted researchers' attention to cognitive psychology (Shrock, 1995). Psychologists' traditional approach to education, which is measuring changes in students' behavior following educational stimuli, is joined with a concern about the process of cognition. They started considering human learning as the product of a cognitive process working based on cognitive rules and strategies rather than solely stimulus-reinforcement contingency. According to cognitive principles, education is control of cognitive processes in the learner. Learning is more and more being understood as recognition of learner knowledge structures by mapping teacher or expert subject matter knowledge onto the learner's knowledge structure (Popkewitz & Shutkin, 1995).

## Advantages of Using Technology

Technology has produced several positive outcomes in education; enhancement of motivation, attitude and enjoyment, new peer interaction patterns and learning performance (Schofield, 1995). The idea that computer use often enhances students' motivation and attitude has been experimented frequently in the recent years. It is supported by many studies that computers are able to enhance student motivation about, interest in and attention to classroom activities.

In a study consisting of 30 fifth grade students in an inner city school, the effect of computer in mathematics, language-arts and social studies were measured. The results showed that the students had more

positive attitudes towards the educational experience and their attitudes improved during the course of the study in the area of confidence (Kitabchi, 1987). Based on a meta analysis of 199 papers of which 32 were conducted in elementary schools, 43 in high schools, 101 in universities and 24 in adult education centers, it was founded that students liked the classes more and developed more positive attitudes toward computers when they received computer help (Kulik et al, 1987).

Having high attitude, students have more enjoyment, work harder and show more involvement in classroom while working on computers. Why are students motivated and enthusiastic with computers? The literature brings some explanations for this question. The first is that students respond well to computers because they are relatively new in their school experience. The second is that students seem they like working on computers because computers introduce variety into the school routine. Another approach is that knowing how to use a computer would be useful to students in the later life (Schofield, 1995).

Educators have been concerned with interactions among students in a computer-supported instructional environment. Many think that students are isolated from the classroom's social environment when using computers. Yet, studies showed that when students deal with computer related tasks interaction among students increases. As a matter of fact the interaction becomes a learning management tool and students' experiences in-group work may have a direct effect on learning and achievement (Webb, 1989)

Peer interaction has been affected by several factors such as student characteristics, the structure of tasks, and the reward structure (Webb, 1989). Besides those factors, locations of computers, the ratio of students to computers and how teachers chose to handle the educational environment when there are more students than computers determine the pattern of interaction among students. Teachers may control collaboration among students through software. One of the purposes of the education is to teach students necessary skills to prepare them for the job market. Even though there are some objections numerous researchers indicate that the computer is a good means towards that purpose. Many studies proved that students better learn in a computer-supported environment than traditional classroom environment.

Kulik (1994) conducted a meta analysis on more than 500 individual research studies of computer-based instruction. He found that on average, students who used computer based instruction scored at the 64<sup>th</sup> percentile on the tests of achievement compared to students in the control conditions without computers who scored at the 50<sup>th</sup> percentile. Also students learned more in less time when they received computer-based instruction. In a similar investigation, 219 research studies on the effect of technologies on learning and achievement across from 1990 to 1997 revealed that students in technology rich environments experienced positive effects on achievement in all major subject areas and showed increased achievement in preschools through higher education for both regular and special needs children (Sivin-Kachala, 1998).

### **Disadvantages of Using Technology**

The technology implementations are not free of risk. Once the technology starts diffusing into schools it comes with unique problems. Some of the important problems are equity and access, time to plan and implement the technology and teachers' resistance to change.

In the technology-based educational change, which could be school-wide, district-wide and statewide, equity and access refers to whether each individual student utilizes computers or the technology at the same level and under the same conditions (Knupfer, 1995). The following variables would explain the obstacles that may cause inequity in the computer access: Geographic region, socioeconomic status, gender, race, various kinds of handicaps, and special learner groups within school. The research indicates that minorities, women, the handicapped and the poor have less access to computers (Anderson, Welch, & Harris, 1984).

Some other factors also may determine the equal access, such as familiarity with hardware and software, the classroom structure, time, students' skill levels and locations of computers. Becker (1985) found that above-average students dominantly use computers. Also, his study revealed that placement of computers within libraries promoted more equal usage of computers between above- and below-average students.

Successful technology adaptation requires a careful planning which demands plenty of time. However, teachers already undergo time shortage with their current tasks (Knupfer, 1995; Hardy, 1998). Time necessary for technology adaptation is not just limited to the planning. Teachers also have to commit some time to learn how to plan the technology integration into curriculum and develop appropriate materials. After all, they will need classroom time to implement the technology. In the current education system, besides other necessary classroom events not enough time is left to carry out instructionally sound and proper computer activities (Dupagne & Krendl, 1992). The literature confirms that teachers who are motivated to use the computer technology in their teaching are more likely to do so if time is provided to develop materials (Hardy, 1998).



Teachers show resistance to educational change in which they should use educational computing. Among several others, two concerns are critical for teachers exhibiting the resistance: Concerns about their machine skills and concerns about taking a risk (Andris, 1996). Teachers are supposed to be competent about computer machine-related skills for classroom and lab activities at least at the elementary level. Though, usually teachers learn those skills through, if possible, school or district supported training and peer tutoring after for a while they do not value their computer machine skills. Although these teachers agree that their machine skills improve over time as they operate computers, they distinguish those skills from other teaching skills and do not recognize them as relevant to their teaching and they do not think, "operating computers make them a better teacher".

It takes time for teachers to become familiar with computer hardware and software. Because technology vendors continuously upgrade their products and schools always acquire new equipment and computer programs, this is a recurrent problem in schools. Teachers indicate that until becoming accustomed to computers and programs their schools have teaching with them becomes less efficient and less productive than teaching with classical methods. They think using unfamiliar computer materials and methods may risk their consistent level of classroom performance as well as effectiveness of their lessons.

### **The Effective Integration of Technology**

The technology integration in classroom is perceived a complex and challenging procedure by new adaptors. Yet, later, getting more expert on educational technology competencies they see the integration easy and useful (Scrogan, 1989). Computers are promising educational tools facilitating teachers' tasks and improving students' performance. In addition to those, technology plays a central role in educational change (Sudzina, 1993). However, still educators exhibit reluctance to integrate computers into classroom (Dunn & Ridgway, 1991).

Researchers have been investigating the reasons why educators at all levels, schoolteachers and university professors; show unwillingness and lack of enthusiasm about the technology. Several causes have been discussed. However, it is very hard to put those reasons into an accurate categorization because they are not clearly separated from each other. Besides their effects on inadequate computer integration, they interact with each other, as well. However a categorization of the factors would be as follow: Environmental (extrinsic) factors and personal (intrinsic) factors (Dusic, 1998; Ertment, 1999). Intrinsic factors are the ones caused by the setting or situation in which the technology is implemented. Extrinsic factors are coming from teachers' personalities and understanding of technology integration.

#### **Environmental factors**

Providing adequate hardware and software is an important factor in promoting technology integration (Zammit, 1992). If computers are not available during convenient times and/or software is unavailable in sufficient quantities or at an adequate level of quality one should not expect high levels of usage regardless of the level of interest (Stieglitz & Costa, 1988). Schoolteachers and university professors indicate that the quality and quantity of hardware and software is insufficient (Hoffman, 1998). Schools and departments need more computers and computer peripherals, such as scanners and data projectors. The ones having computers and peripherals should continuously upgrade them due to the rapid change in technology. Software is not satisfying the educators' need. Teachers generally evaluate software as being pedagogically weak or inappropriate and think it is not worth the effort to use it (Zammit, 1992). What is generally needed is well designed, adaptable, user-friendly and uncomplicated computer programs. (Hardy, 1998; Downes, 1993; Ritchie, 1996; Cafolla & Knee, 1995; Sheingold & Hadley, 1990; Dunn & Ridgway, 1991)

Support also plays an important role in technology diffusion in education. The support may be in three different forms: Technical support, pedagogical support and management support. Technical support is important because teachers and faculties always need help with the equipment in classrooms. Most of the time, they are not able to overcome technical problems occurring during instructions and need to call a support person (Dusic, 1998; Hardy, 1998).

Pedagogical support is related to technology planning, development, implementation and teacher consulting. Pedagogical support should be provided by technology coordinators (Zammit, 1992). Technology coordinators are supposed to inform teachers of how to use certain equipment. Equipment use is not necessarily only limited to physical use but related to how that piece of technology is integrated into instruction, how to plan for its use, and how to improve students learning performance and motivation. Also, technology coordinators should enlighten teachers with concurrent educational technology innovations and learning theories/models (Ritchie, 1996). Hoffman (1998) claims that the pedagogical support provided by the coordinators leads to greater use of software

that promotes higher order thinking skills, and greater use of computers as tools in academic activities rather than as mere drill-and-practice.

School boards, districts and school management are not providing adequate administrative support for technology infusion (Cafolla & Knee, 1995). Administrators from different management levels are key people making strategic and executive decisions within schools or school systems and universities. With those decisions, administrators may provide teachers with directions about educational technology use, involve teachers in the technology adaptation process, provide necessary hardware and software, provide incentives that can encourage and motivate teachers to start and continue integrating technology into their lessons (Hoffman, 1998; Knupper, 1989; Dupagne & Krendl, 1992). One solution to overcome this problem and widespread the technology in schools is to train administrators on educational technology and make them comfortable computer users so that their attitude towards technology is improved and they provide more help teachers to integrate technology in their lessons (Ritchie, 1996). The following factors are also considered related to teachers' educational computer use: Risk of using technology, sharing of technology resources between teachers (Dusic, 1998), discouraging climate to use computer within schools, lack of use of computers for personal purposes and not having a computer at home (Downes, 1993).

### **Teacher training**

To this point, several environmental factors, such as lack of hardware and software, pedagogical and technical support, management support and so forth, have been discussed. Teacher training also occupies an important place as an environmental obstacle (Hardy, 1998; Dusic, 1998). Significant number of teachers had very little in-service training about educational technology (Zummit, 1992). This might be the reason that one of the major concerns teachers and faculties carry is "hows" of using technology in the classroom (Dupagne & Krendl, 1992). Instructional computer applications require new competencies and knowledge. Not having those competencies and knowledge, teachers should not be expected to adopt technology in the classroom (Marcinkiewicz, 1995). Successfully technology-using teachers indicate that they learned their technology skills thorough formal and non-formal training; such as workshops, courses at local colleges, in-service training offered by their districts, in-service training at their school site and non-in-service courses offered by districts (Hoffman, 1998).

Even though teachers have positive attitudes towards technology and want to improve their teaching performance through technology implementations they are not able to accomplish it. They are not having knowledge to use the machine, and not having any kind of familiarity or expertise with computer based or computer managed instruction (Onika, 1992). The reason is that experienced teachers have not had appropriate training on how to effectively use the computer in the classroom and on technology, skills, ideas and ways to integrate instructional technology into the curriculum (Dunn & Ridgway, 1991). In addition to this, new teachers have very limited knowledge about educational computer use. Teacher students do not have adequate exposure to instructional technology because many educational institutions and faculties within those institutions have not adopted technology. Whereas, the more teachers have exposure to and experience with computers the better they integrate computers into their teaching. (Hardy, 1998)

Comprehensive staff technology teacher development models and programs are needed. Those programs should provide clear directions for teachers on integrating technology in classroom and help them construct the purpose and meaning of educational technology (Hardy, 1998). The training should be designed in a way so that it contributes to teachers' continuous development. Therefore, new adopters or new teachers should be encouraged to try out their developing IT skills early in their carriers, and not wait until their theoretical knowledge is highly developed (Dunn & Ridgway, 1991).

### **Personal Factors**

Besides environmental factors as explained above, some psychological factors or variables, such as confidence, fear, will and motivation, may determine teachers' use of technology in classroom. Hardy (1998) indicates that around 40-50 percent of teachers avoid using computers because they lacked confidence, felt uncomfortable, and were frightened, threatened and intimidated by computers. Sometimes teachers' or faculties' belief about technology and education may determine their behavior towards technology use. They think computers are complicated machines to use and master. Also, some think it is a temporary movement within current schooling system rather than a useful trend. Teachers' traditional belief and experience with schooling inhibits them from taking instructional risks and implementing technological innovations in the classroom (Sudzina, 1993).

The literature concentrates on three major personal variables or factors: Anxiety about technology, teachers' or faculties' personalities and attitudes towards the technology integration. The major indicator of computer anxiety is avoiding from or interacting with computers (Dusic, 1998). Hardy (1998) indicates in a study investigating computer aversion it was found that teachers are very hesitant about computer related tasks, which includes using computer machine and related peripherals in teaching, helping fellow teachers when they have trouble with computers and applying to a job requiring an initial computer training. Some reasons are brought for computer anxiety, such as inadequate planning and applications of technology-based educational change and ineffective communication between instructors and administrators (George, 1996). Jordan (1993) adds the following three reasons: "Teachers, trained to master the traditional tools and materials of their profession, fear their lack of expertise with computers will be embarrassing and undermine their classroom authority, some teachers may be uncomfortable with the ways that classroom roles and relationships between teacher and student change when computers are introduced into the classroom, teacher productivity and student success can be monitored with computers easily, but many teachers worry about accountability since the problem solving skills they try to teach may not be measurable through assessment instruments they have been using". Improving self-efficacy would be a useful method to decrease teachers' anxiety. Self-efficacy is achieved through helping teachers use computers effectively, having them observe other successful users, mentoring teachers on the educational technology and creating anxiety-free environments or situations (Dusic, 1998).

Psychologists classify people according to their personalities. Some empirical research data shows that there are connections between educators' types of personalities and use of educational technology. Smith et al. (1995) attributes the features of being creative, analytical, logical and imaginative to institutive/thinking types of educators and says they are more open to educational technology than sensory types of people who are practical, realistic and sociable. On the other hand, comparing the other personality traits, sensory/feeling types of people show very reluctant behavior towards adapting technology in the classroom. In a similar study, the personality types were classified as follow: extraversion/introversion, sensing/intuition, thinking/feeling, judging/perceptive and it was found that those personality variables may determine the amount of technology training taken, perceived adequacy of the training, perceived support from management and perceived factors or barriers to adapt computers in curriculum (Knupper, 1989).

### **Teacher attitude**

Teacher attitude is the most commonly used term in the literature to describe practitioners' appealing to educational computing. For instance some teachers perceived that computers did not provide a distinct advantages over traditional methods of teaching (McCormak, 1995) some others value them as a useful tool to support meaningful learning. Attitude is defined as evaluative disposition based on cognition, effective reactions and behavior intentions and determines future behavior as using the computer as a professional tool and integrating technology in the classroom (Dusic, 1998). As can be seen from the definition it covers a very broad meaning. Due to that it is used interchangeably with motivation and anxiety. As a matter of fact, attitude scales are created based on other psychological states. For instance, Loyd (1985) created a computer attitude scales derived from computer anxiety, computer confidence, computer liking and computer usefulness. Computer anxiety is related to fear of computer, computer confidence is about self-reliance to learn and use computers, computer liking is enjoyment from working with computers and computer usefulness is related to perceived effectiveness of computer.

Significant attitudinal difference towards educational computing is found between teachers who are technology users and those who are non-users (Galowich, 1999). The more teachers are willing to use computers in the classroom, the more their attitudes are favorable toward computers (Dupagne & Krendl, 1992). In addition to that, the teacher attitude is significantly related to computer literacy knowledge. Also, it is expected that there is a connection between using computer outside of work and the attitude (Galowich, 1999). Attitude is not a clear-cut measure to indicate teachers' disposition towards technology, such as high/good attitude and low/bad attitude. Teachers having different experiences, varieties of supports and different incentives and barriers may exhibit different attitudes.

### **References**

- Anderson, R. E., Welch, W. W. & Harris, L. J. (1984). Inequities in opportunities for computer literacy. *The computing teacher*, 11(8), 10-12
- Andris, M. E. (1996). *An apple for the teacher. Computers and works in elementary schools*. Crowin Press: California

- Becker, H. J. (1985). *How schools use computers: Summary of the first national survey*. Baltimor, MD: Center for Social Organization of Schools, The Johns Hopkins University.
- Cafolla, R. & Knee, R. (1995) Factors limiting technology integration I education: The leadership gap. Available [online] [www.coe.uh.edu/insite/elec\\_pub/html1995/152.htm](http://www.coe.uh.edu/insite/elec_pub/html1995/152.htm)
- Chiero, R. T. (1997). Teachers' perspectives on factors that affect computer use. *Journal of Research on Computing in Education*, 30(2), 133-145
- Diem, R. (1996) *Information technology and civic education. Computers in Social Studies Education*. New York: Routledge
- Downes, T. (1993). Student-teachers' experiences in using computers during teaching practice. *Journal of Computer Assisted Learning*, 9(1), 17-33
- Dunn, S. & Ridgway, J. (1991). Computer use during primary school teaching practice. A survey. *Journal of Computer Assisted Learning*, 7(1), 7-17
- Dupagne, M. & Krendl, K. A. (1992). Teachers' attitude toward computers: A review of the literature. *Journal of Research on Computing in Education*, 24(3), 420-429
- Dusick, D. M. (1998). What social cognitive factors influence faculty members' use of computers for teaching? A literature review. *Journal of Research on Computing in Education*, 31(2), 123-137
- Ertmer, P. A., & Hruskocyc, C. (1999). Impacts of a university-elementary school partnership designed to support technology integration. *Educational Technology Research and Development*, 47(1), 81-96
- Galowich, P. (1999). Learning styles, technology attitude and usage: What are the connections for teachers and technology in the classroom? (ERIC Document Reproduction Service ED432312)
- George, G. et al. (1996). Managing instructor cyber anxiety: The role of self-efficacy in decreasing resistance to change. *Educational Technology*, 36(4), 49-
- Cuban, L (1985). *Teachers and machines*. Teachers Collage Press: New York, London.
- Hardy, J. V. (1998). Teacher attitudes toward and knowledge of computer technology. *Computers in the Schools*, 14(3/4), 119-136
- Hoffman, B. (1998). Managing the information revolution: Planning the integration of school technology. *NASSP Bulletin*, 80(582), 89-98
- Kitabchi, G. (1987). Evaluation of the Apple Classroom Tomorrow. (ERIC Document Reproduction Service ED295600)
- Knupfer N. N. (1995) Teachers and educational computing: Changing roles and changing pedagogy. In Robert Muffoletto and Nancy N. Knupfer (ed.) *Computers in Education*. Hampton Press: New Jersey
- Knupfer, N. N. (1989). The Relationship between elementary teachers' psychological types and their uses of educational computing (ERIC Document Reproduction ED308824)
- Kulik, J. & Kulik, C. C. (1987). Computer-based instruction: What 200 evaluations say. (ERIC Document Reproduction Service ED285521)
- Kulik, J. A. (1994) Meta-analytic studies of findings on computer based instruction. In E. L. Baker, and H. F. O'Neil (Eds). *Technology Assessment in Education and Training*. Lawrence Erlbaum: New Jersey
- Loyd, B. H. & Loyd, D. E. (1985). The reliability and validity of an instrument for the assessment of computer attitudes. *Educational and Psychological Measurement*, 45, 903-908
- Marcinkiewicz, H. R. (1995). Differenced in computer use of practicing versus pre-service teachers. *Journal of Research on Computing in Education*, 27(2), 184-197
- McCormak, V. (1995). Training pre-service teachers in applying computer technology to lesson planning as a component of the elementary school methods curriculum. (Eric Document Reproduction Service ED382190)
- Onika, R. (1992) The Factors That Affect Teacher Attitude towards Computer Use. (ERIC Document Reproduction Service ED346039)
- Popkewitz T. S., & Shutkin, D. (1995) Social science, social movements and the production of educational technology in the U.S. In Robert Muffoletto and Nancy N. Knupfer (ed.) *Computers in Education*. Hampton Press: New Jersey
- Ritchie, D. (1996) The administrative role in the integration of technology. *NASSP Bulletin*, 80(582), 42-52
- Schofield, J. W. (1995) *Computers and classroom culture*. Cambridge University Press: New York.
- Scrogan, L. (1989). The OTA report: Teachers, training, and technology. *Classroom Computer Learning* 1, 66-70
- Sheingold, K. & Hadley, M. (1990). *Accomplished teachers: Integrating computers into classroom practice*. Center for Technology in Education. Bank Street College of Education.
- Shrock, S. A. (1995) A brief history of instructional development. In Gary J. Anglin (ed.) *Instructional Technology: Past, Present, and Future*. Englewood, CO: Librarians Unlimited, 11-19

Sivin-Kachala, J. (1998) Report on the effectiveness of technology in schools, 1990-1997. Software Publisher Association

Smith et al. (1995). Prediction of teachers' use of technology based on personality. *Journal of Instructional Psychology*, 22(3), 281-

Stieglitz, E. L. & Costa, C. H. (1988). A statewide teacher training program's impact on computer usage in the schools. *Computers in the Schools*, 5(1/2), 91-97

Sudzina, M. R. (1993). Technology, teachers, and educational reform: Implications for teacher preparation. (ERIC Document Reproduction Service ED355207)

Webb, N. M. (1989) Peer interaction and learning in small groups. *International Journal of Educational Research*, 13(1), 21-39

Zammit, S. A. (1992) Factors facilitating or hindering the use of computers in schools. *Educational Research*, 34(1), 57-66

# **The Effects Of Computer Training On Turkish Teachers' Attitudes Toward Computers And The Effects Of Computer-Supported Lessons On Turkish Students' Reported Motivation To Lessons**

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## **Abstract**

Within the last 20 years, the quantity of computers in American schools has significantly increased. However, teachers have not been adequately using computers in the classroom. With a similar trend, the Turkish Ministry of Education has invested significant amount of money to purchase computers for public schools in Turkey. In this study, the effect of an educational computing training program on Turkish teachers' attitudes toward computers and the effect of computer-integrated classes on Turkish students' motivation will be investigated.

The subjects of this study are 21 middle school teachers and their school students in Turkey. There are two independent variables. The first independent variable is teacher training. The second one is computer-supported instruction implemented by the trained teachers.

## **Introduction**

This study will investigate the use of computers in Turkish schools through teachers' attitudes toward computers and students' motivation to utilize computer-integrated lessons. However, since empirical studies about computer usage in Turkish schools could not be located, some data for American schools will be presented first to indicate what might also be true for Turkish schools.

Within the last 20 years, the number of computers in American schools has significantly increased. While there were 46,000 school computers in 1980 (Adams, 1985), the Office of Technology and Assessment (1995) reported that this number had increased to 400,000 by the end of the 1980s. As of 1994, schools nationwide owned an estimated 5.5 million computers (Mehlinger, 1996). Even though the number of school computers increased sharply, the percentage of computer use by teachers for instructional has remained low. The Office of Technology Assessment (1995) reported that, "a substantial number of teachers indicated little or no use of computers for instruction." Based on a national survey, Becker (1991) reported that only 17% of secondary mathematics, science, and English teachers utilized computers in the classroom "throughout the year" or "intensively, but only for certain units."

Another issue in educational computing is that computers have not been employed in an appropriate manner in the classroom. There are large qualitative gaps among teachers in using computers for instruction. Sheingold and Hadley (1990) conducted a research study on who were exemplary computer using teachers and noted what made them the exemplary. It was found that exemplary teachers utilized the computer as a multipurpose tool. On average, 95% of the exemplary teachers used the computer as a word processing tool, 89% as an instructional tool, 87% as an analytic and information tool, 84% as a programming tool, and 81% as a game/simulation tool. On the other hand, a 1989 national survey on how computers are usually used in American schools revealed that only 1% of computer-using math teachers applied spreadsheets more than five times during a year, while just 11% of computer-using English teachers said they used spell checkers regularly (Becker, 1991, 1994). This was a sharp distinction when compared to 56% and 61%, respectively, between exemplary computer using teachers and typical computer using teachers (Sheingold and Hadley, 1990).

Possible reasons for these discrepancies may be that teachers do not have the knowledge and skills about how to adapt computers to the curriculum or they have not received adequate teacher training on educational computing. The American Association of Colleges for Teacher Education (1987) conducted a survey among new teachers. This survey revealed that only 20% of the teachers entering the profession perceived themselves as prepared to teach with computers. In another study, Wiley (1992) selected 231 teachers to survey who would participate in a technology staff development program. He found that though these teachers had positive attitudes toward computers, they had insufficient knowledge about computers and strategies to effectively integrate computers into the curriculum. Okinaka (1992) concluded that lack of knowledge or understanding on how computers can be effectively used in the classroom is the most significant factor slowing the computer adoption process by teachers.

The purpose of this study is to understand how Turkish teachers respond to an instructional computing training program design based on data from research conducted in the United States, and how Turkish students respond to computer integrated lessons created by trained teachers. More specifically, this study is to investigate whether computer trained Turkish teachers improve their attitudes toward utilizing computers in regular course instruction. In addition, this study will investigate whether Turkish students' motivation toward lessons, i.e. mathematics, science, and Turkish, could be improved through computer-integrated classes designed and implemented by trained teachers.

## **Literature Review**

Kay (1993) constructed and applied a 7-point Likert-type computer attitude measure based on four constructs. These constructs were affective attitude, cognitive attitude, behavior, and perceived control over computers. She found that there were significant relationships between affective attitude toward computers and computer behaviors, as well as cognitive attitude toward computers and computer behaviors. In another study, Pencer et al. (1992) surveyed 230 psychology undergraduate students to predict computer-related behavior based on computer-related attitude. Regression analysis shown that 17 computer-related behaviors could be predicted from the subjects' underlying attitudes.

For validating a scale to assess changes in teachers' attitudes toward computers, Kluever et al. (1994) surveyed 265 teachers participating in a training program. Significant difference was found between the students' attitude toward computers pretest scores before the training and posttest scores after the training. Yildirim (2000) investigated "the changes in attitudes of pre-service and in-service teachers due to participation in an educational computing class and the factors that contributed to the teachers' use of computers." It was found that after the class teachers' computer anxiety was significantly decreased and their computer liking and computer confidence were significantly increased.

Investigating the relationship among computer achievement, attitude toward computers, and environmental variables - such as computer access, computer help, and computer requirements - Liu & Johnson (1998) conducted research involving 138 female and 70 male teacher education students enrolled in a required basic computer technology course. The regression analysis showed that there was a significant motivational impact on students' learning performance.

A study was conducted by Perez and White (1985) to "explore motivational and educational differences between microcomputer activities and classical classroom activities." In the study, it was concluded that "a computer learning environment introduces and increases usage of varied motivational and educational factors which have the potential to improve learning as well as academic interests" (p.42).

Seymour and Sullivan (1984) surveyed 139 fifth and sixth grade students in six classrooms to investigate the relationship among continuing motivation of instructional medium, task difficulty, and sex of subjects. The two media that were used as instructional interventions were computer and paper/pencil with two difficulty levels: hard and easy. Continuing motivation was defined as "students' choice of instructional medium for a second learning task after they had completed an initial task either on a microcomputer or paper/pencil form." Factorial ANOVA analysis detected that there was a significant motivational difference between the two groups in terms of preferring one of the two learning mediums for a possible second learning task.

## **Method**

### **Participants**

The participants of this study are middle school teachers and their students of a private school in Turkey that offers kindergarten through eighth grade. The number of middle school teachers participating in this study is 21 (ten females and eleven males). Their distribution according to the subjects they teach and gender is as follow: four mathematics (two females and two males), two science (two males), four Turkish (two females and two males), three social science (one female and two males), and eight English (five females and three males). Their teaching experience ranges from two to ten years with an average of 4.5 years.

### **Independent Variables**

Since there are two interventions in this study, there are two independent variables. The first independent variable is teacher training. The second is computer-supported instruction implemented by the trained teachers in the actual classroom environment.

The first independent variable, teacher training, had two levels: (a) no teacher training and (b) teacher training. The training was designed to teach in-service Turkish teachers educational computing competencies rated as important or very important by their American counterparts. During the training, Turkish teachers were provided with exposure to, knowledge about, and experience with educational computing.

Initially, teacher computer competencies were identified. The first set of competencies was identified by Scheffler (1995), who found 127 teacher computer competencies through literature review and interview with computer representatives. Using the Delphi technique and survey method, Scheffler (1995) reduced 127 competencies to 67.

In another study used to discover teacher computer competencies, Berg et al. (1998) utilized two evaluation phases to identify exemplary technology uses by teachers and students in elementary classrooms in southwestern Ohio. 39 distinct exemplary classroom applications of computers were found, 11 of which were specifically for teachers.

The specific computer competencies taught in the training were derived from those two lists. From the first list, the items that were rated 4 or 5 (important and very important) and related directly to teaching and learning activities performed by classroom teachers were selected. The ones that were not directly related to computer skills teachers may require, not directly related to teaching and learning in the classroom, and the ones that were similar in nature were eliminated. Some eliminated competencies were "demonstrate to students and other classroom teachers the computer as a beneficial tool that increases efficiency and productivity," "demonstrate skills in using a computer keyboard," "demonstrate appropriate use of computer technology for basic skill instruction," "use modem for communication between computers," "define elements of a local educational agency technology plan," and "plan methods to integrate computer awareness and literacy into the existing curriculum." This elimination resulted in 26 usable competencies.

From the second list created by Berg et al. (1998), the competencies specific for teachers and rated 5 or 6 (moderately important and highly important) were selected. This selection resulted in 5 competencies. The total competencies grew to 31

The second independent variable, teachers' implementation of a computer-supported class in an actual classroom, environment, has two levels: (a) implementing a computer-supported class in the classroom and (b) implementing a non-computer-supported (classical) class in the classroom. After the training, teachers will be required to design and implement a sample course in an actual classroom setting using the skills, knowledge, and competencies acquired through the training. This second intervention will be used to measure to what extent teachers who had the educational computer training will increase their students' motivation towards lessons.

## **Dependent Measures**

There will be two dependent measures:

1. Teachers' attitude towards computers as measured by the Computer Attitude Scale.
2. Students' motivation towards courses by the Course Interest Survey.

Attitude is defined as "an evaluative disposition based upon cognition, effective reactions, behavior intentions, and past behaviors which can influence future cognitions, effective responses, intentions, and behaviors" (Dusic, 1998). In this study, the Computer Attitude Scale (CAS) (Loyd & Loyd, 1985) will be employed to measure teachers' attitudinal change towards computers after the intervention.

The CAS has 40 Likert-type items presenting statements of attitudes towards computers and the use of computers. The items are divided into four categories each of which represents one subscale of the CAS: (a) anxiety or fear of computers that represents the Computer Anxiety (CA) subscale, (b) confidence in ability to use or learn about computers that represents the Computer Confidence (CC) subscale, (c) liking computers or enjoying working with computers which is the Computer Liking (CL) subscale, and (d) perceived usefulness of computers in present or future work representing the Computer Usefulness (CU) subscale. Each subscale has ten items and respondents rate items by indicating to what extent they agree or disagree with the expressions in each item (from strongly disagree to strongly agree with four choices)

The estimated total alpha reliability coefficient of the CAS is 0.95 with the following coefficients for the subscales: 0.90 for Computer Anxiety, 0.89 for Computer Confidence, 0.89 for Computer Liking, and 0.82 for Computer Usefulness. The CAS is a reliable and valid instrument to assess teacher attitudes toward computers (Loyd & Loyd, 1985).



Driscoll (1993) defined learning motivation for a student as "deciding to engage in a learning task and persisting in that task." In this study, Keller's (1995) Course Interest Survey (CIS) was used to measure students' motivation toward computer-supported and non-computer-supported lessons. The CIS measured students' motivation to learn in a particular course. It had 34 items divided into four categories: (A) attention, (R) relevance, (C) confidence, and (S) satisfaction. The items in the attention category measure whether the interest of learners was captured and their curiosity to learn stimulated by the lesson. The relevance items inquire as to whether the personal needs/goals of the learner were met to affect a positive attitude. Items related to confidence evaluate the perception of learners about whether they will be able to succeed and control their success. Finally, the satisfaction items measure whether students' accomplishments in the classroom were reinforced.

Cronbach's alpha coefficient for the total survey was found to be 0.95. The subscales' coefficient values were: 0.84 for attention, 0.84 for relevance, 0.81 for confidence, and 0.88 for satisfaction. Additionally, it was found that there were significant correlations between the CIS results and course grades (Keller, 1995). They show that CIS was a reliable and valid tool to measure students' motivation in a specific classroom situation.

Both instruments, the CAS and CIS, were originally written in English and the English versions were validated. Because the teachers' and students' native language in this study is Turkish, the researcher will translate the English versions of the surveys into Turkish. The translated surveys will be checked and corrected by two language experts. The language experts are studying Turkish linguistics and literature in the United States, and are fluent in both American English and Turkish. No data is available about the reliability of the Turkish versions of the surveys. They will be calculated after the surveys are administered.

## **Procedure**

Using a stratified random sampling method, I assigned 21 middle school teachers to either a control group or an experimental group. First, all 21 teachers were stratified according to their subject matters: mathematics (four), science (two), social science (four), Turkish (three), and English (eight). Second, half of the teachers within each stratified group were randomly assigned to either a training group or a control group. However, some teachers who were randomly assigned to the training group indicated that they would not be available for the training. They were then replaced with teachers in the control group. This assignment resulted in 11 teachers in the training group and 10 teachers in the control group. All 21 teachers will complete the Teacher Consent Form and the CAS before training is administered.

The training will take place at the school site. It will be given by the researcher in Turkish and take approximately 30 hours. The training will be given in a classroom lecture format to provide teachers with verbal information on how computers can be integrated into curriculum. Besides the lectures, computer lab sessions will be arranged to provide teachers with hands-on computer skills and competencies. From the instructional flow diagram, it is predicted that the lab section will take approximately 15 hours and the class section 20 hours.

After completing the training, teachers will design a sample computer-supported class based on the knowledge and skills they gained through training and implement that sample class in an actual classroom setting. Before implementation, each teacher will have students complete the Student Consent Form and the CIS. After the implementation of the computer-integrated class, students will again complete the CIS. Meanwhile, when teachers in the control group teach the same topics in the same lessons, such as mathematics, science, and Turkish without computer support, they will have their students complete the Consent form as well as the CIS. Finally, all 21 teachers will fill out the CAS.

Because the same students and the same teachers will answer the pretest as well as the posttest, pretest sensitization is an issue. Pretest sensitization refers to "improved score on a posttest resulting from subjects having taken a pretest. In other words, taking a pretest may improve performance on a posttest, regardless of whether there is any treatment or instruction in between" (Gay, 1996). To avoid the pretest sensitization, the pretest will be administered at the beginning of the study. This will make approximately 50-day gap between pretest and posttest. This time gap may minimize the pretest sensitization (Gay, 1996).

## **Hypotheses**

Derived from the four research questions in the Introduction section, two hypotheses are provided. Each hypothesis was based on the information in the literature review section.

Hypothesis 1: Effect on Teacher Attitude Towards Computers

That the trained teachers will change their attitude towards computers, which will be detected by the CAS employed after the training. More specifically, that the teachers who receive the educational computer training, which aims to teach the computer competencies rated as important or very important by American computer using teachers, will record higher scores on the attitude questionnaire than those teachers in the control group who receive no training.

#### Hypothesis 2: General Effect on Students' Motivation

Students who receive the computer-supported classes will exhibit higher motivation detectable by the CIS form. In addition, students who have computer-supported classes, designed and implemented by the teachers who received the educational computer training, will exhibit higher motivation towards the lessons than those students who receive the same versions of the classes with no computer support.

## Research Design and Data Analysis

For each hypothesis, a different research design and data analysis technique will be employed to minimize the statistical errors.

Hypothesis 1: For the first hypothesis, the research design technique will be a pretest/posttest control group design. Because the study deals with differences in teachers' computer attitudinal scores, a control group will be used to better understand whether the motivational difference between the control and experimental groups is due to the treatment, and not due to other factors. In this type of design, there are two groups of subjects, both of which are given a pretest of the dependent variable. Then, one group receives treatment and the other group does not. Finally, both groups take the posttest. The effectiveness of the treatment is determined by comparing the posttest scores (Gay, 1996).

In this study, there are only 21 teacher subjects. This limited number of subjects may bring some questions about validity and reliability of research due to the violation of some assumptions in parametric tests. For the data analysis of the first design, the Wilcoxon-Mann-Whitney test will be employed to measure the significance of the training. The Wilcoxon-Mann-Whitney test is a powerful non-parametric test that is useful alternative to a t-test procedure when a researcher wants to avoid the negative effects of assumptions in parametric statistics, such as the normal distribution assumption and equal variance assumption (Siegel & Castellan, 1988).

Hypothesis 2: Similar to the previous method, the pretest/posttest control group experimental design procedure will be employed for the second hypothesis. Because analysis of pretest/posttest gained scores has several disadvantages, pretest differences can be better controlled by covariance (Gay, 1996). Thus, ANCOVA (analysis of covariance) will be employed for data analysis in this study, and pretest scores will be used as a covariate.

Because no study was found where the CAS and CIS were administered to the control group and the experimental group at the same time, no previous data is available about the mean scores and variances of both groups, and statistical power cannot be estimated without this information (Feldt, 1993). After collecting data and calculating descriptive statistical values, the statistical power will be calculated.

## References

- Adams, J. G. (1985). Computer competencies needed by existing Georgia post-secondary vocational technical business education students. Unpublished doctoral dissertation, University of Georgia, Athens
- Becker, H. J. (1991). How computers are used in United States schools: Basic data from the 1989 I.E.A Computers in Education Survey. *Journal of Educational Computing Research*, 7, 385-406.
- Berg, S. et al. (1999). Exemplary technology use in elementary classrooms. *Journal of Research on Computing in Education*, 31(2), 111-122.
- Driscoll, M. P. (1993). *Psychology of learning for instruction*. Needham Height, MA: Ally&Bacon.
- Dusick, D. M. (1998). What social cognitive factors influence faculty members' use of computers for teaching? A literature review. *Journal of Research on Computing in Education*, 31(2), 123-137.
- Gay, L. R. (1996). *Educational research: Competencies for analysis and application*. Englewood Cliffs, NJ: Prentice-Hall.
- Kay, R. H. (1993). An exploration of theoretical and practical foundations for assessing attitudes toward computers: The computer attitude measure (CAM). *Computers in Human Behavior*, 9, 371-386.

- Keller, J. (1995). *Motivation by design*. Tallahassee, Florida: Florida State University, College of Education
- Kluever, R. C., Lam, T. C. M., Hoffman, L. R., Green, E. K., & Swearingen, D. L. (1994). The computer attitude scale: Assessing changes in teachers' attitudes towards computers. *Journal of Educational Computing Research*, 11(3), 251-261.
- Liu, L., & Johnson, D. L. (1998). A computer achievement model: Computer attitude and computer achievement. *Computers in the Schools*, 14(3-4), 33-54.
- Loyd, B. H., & Loyd, D. E. (1985). The reliability and validity of an instrument for the assessment of computer attitudes. *Educational and Psychological Measurement*, 45, 903-908.
- Mehlinger, H. D. (1996). School reform in the information age. *Kappan*, 77(6), 400-407.
- Office of Technology Assessment (1995). *Teachers & Technology: Making the connection*. Washington, DC: U.S. Government Printing Office.
- Okinaka, R. (1992). The factors that affect teacher attitude towards computer use. (ERIC Document Reproduction Service No. ED 346 039)
- Pencer, S. M., George, M., & Gebotys, R. J. (1992). Understanding and predicting attitudes towards computers. *Computers in Human Behaviors*, 8, 211-222.
- Perez, E. C., & White, M. A. (1985). Student evaluation of motivational and learning attributes of microcomputer software. *Journal of Computer-Based Instruction*, 12(2), 39-43.
- Scheffler, F. L. (1995). The identification of computer competencies needed by public school teachers. Unpublished Doctoral Dissertation, University of Kentucky.
- Seymour, S. L. et al (1986). Microcomputers and continuing motivation. (ERIC Document Reproduction Service No. ED 267 791)
- Wiley, (1992). Relationships between teachers' attitude, knowledge, and concerns about computers in education and concern-based approach to staff development. *Dissertation Abstracts International*, 54(01A), 151.
- Yildirim, S. (2000). Effects of an educational computing course on pre-service and in-service teachers: A discussion and analysis of attitudes and use. *Journal of Research on Computing in Education*, 32(4), 479-495.

# Formation of Community in a Distance Education Program

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## Abstract

*One of the biggest challenges facing distance education programs is attrition. One potential way of reducing attrition is to foster a sense of community among students. Students who are emotionally and intellectually invested in each other and in their program are more likely to prosper in a multi-year distance program. This paper briefly explores those effects ascribed to community that are assumed to be crucial for distance education programs to succeed, and then focuses on a theoretical framework known as the Psychological Sense of Community (PSOC). From this basis the communication between graduate students in a distanced education cohort is explored to see how well the PSOC can be applied to this environment.*

## Introduction

The advent of the World Wide Web has brought with it a massive proliferation of distance education options, many of them based around extensive online communication. Unlike the correspondence courses that preceded them, this new brand of distance education features opportunities for student-student and student-teacher interaction. Many are also built on a different economic model; a full degree program may take several years, requiring a long-term commitment between the student and the offering institution.

Modern pedagogical models encourage the use of group work, learning communities and cohorts to help prepare students for a work world in which teamwork plays an important role. Implemented as a distance education option, this model requires a robust technology infrastructure and intensive faculty involvement — requirements that have a significant economic impact. A program that experiences high attrition (for example, starts with 20 students and ends up with only 3 at the end of a 3-year degree program) will quickly become a monetary sinkhole as course design, development, and faculty interaction time is subsidized by fewer and fewer students.

With both pedagogy and attrition in mind, many scholars have begun to focus on creating community, particularly “learning communities.” Unfortunately, the terms are often vaguely defined. How does one know to what degree community is present? What positive attributes can we ascribe to such a community if it does exist?

This paper briefly explores those effects ascribed to community believed to be crucial for distance education programs to succeed, and then focuses on a specific theoretical framework, the Psychological Sense of Community (PSOC), that seeks to define community. From this basis, the communication between graduate students in a distance education cohort is explored to see how well the PSOC can be applied to this environment.

## Review of the Literature

### Distance education and attrition

Among the challenges faced by those implementing a distance education program — poorly understood technology, high demands on faculty time, and growing competition — perhaps the most significant challenge comes in the form of attrition. Reports of attrition rates at the course level in distance education vary wildly from study to study but are generally higher than on-campus courses (Dille & Mezack, 1991; Kember, 1995).

Isolation, “the state where one's achieved level of social contact is lower than one's desired level of contact” (Altman, 1975), is one of the most prevalent reasons given for dropping out of distance education courses (Morgan & Tam, 1999). Cut off from in-class as well as serendipitous encounters with their classmates and instructors, students lose the sense that they belong to something (Morgan & Tam, 1999; Want & Grimes, 2000).

Attrition can potentially be addressed through the formation of a learning community, specifically by engendering in students feelings of belonging. Of course, feeling isolated is not the only factor influencing student drop-out (Brown, 1996; Nippert, 2000; Want & Grimes, 2000), but belonging to a community seems to serve both the student and the institution by reducing such feelings and hence attrition (Haythornthwaite, Kazmer, Robins, & Shoemaker, 2000; McCarthy, Pretty, & Catano, 1990; Morgan & Tam, 1999; Palloff & Pratt, 1999). Encouraging a sense of community, then, offers us a way to address the issue of retention.

## **Community and attrition**

Lack of community is linked with two student attributes associated with attrition: student burnout (McCarthy et al., 1990) and feelings of isolation (Haythornthwaite et al., 2000). McCarthy et al. (1990) note that undergraduates who experience a strong psychological sense of community in their living environment reported lower burnout on the Meier Burnout Assessment and the Maslach Burnout Inventory, compared to students who did not. They suggest that programs and interventions to prevent or decrease burnout should focus not simply on individual students (such as improving their coping skills), but the college community itself. Haythornthwaite et al. (2000) found that students who do not make connections with their classmates at a distance “report feeling more isolated and stressed than those who are more active; exchanges with other students become vital for validating their experiences and for overcoming isolation” (p. 1).

## **Learning communities and virtual communities**

The notion of a community of learners has been gaining currency in various educational fields for a number of years. Similar in many respects to Lave and Wenger’s (1991) community of practice, a community of learners, or learning community, can take a number of forms and can fulfill a variety of needs. This term has become a buzzword applied to almost any educational or workplace group, especially with respect to online or virtual communities. While there is a wide variety of research focusing on such learning communities, many (Baker & Moss, 1996; Bielaczyc & Collins, 1999; Boehmer & Waugh, 1997; Brower & Dettinger, 1998; Cross, 1998; Hill, 1985; Lawrence, 2000; Pike, 1997; Shapiro & Levine, 1999; Wilson & Ryder, 1996) seem to accept the term at face value without attempting to rigorously define the characteristics that differentiate a true learning community from any other class. Others describe characteristics of community, but do not offer a way to evaluate presence or level of community (Bauman, 1997; Bruckman, 1996; Cox, 1997; Donath, 1999; Everhart, 1999; Kim, 2000; Kollock & Smith, 1999; Preece, 2000; Schwier, 2001; Selznik, 1996; Wellman & Guila, 1999a) .

Linked to this question of how to evaluate the existence and effectiveness of community are the ways in which researchers view community. The preponderant method is to establish a list of characteristics indicating the presence of community. Using these characteristics as a lens, the researcher then looks for indicators of those characteristics in the available data, and determines whether (or to what extent) the group is a community (see, e.g., Kim, 2000; Schwier, 2001; Selznik, 1996; Wenger, 1998).

Another way to define community is through its structure. Social network theory uses relationships among people (as defined by “weak” and “strong” ties and relations) to determine a person’s social network (Wellman, 1979, 1999; Wellman, Carrington, & Hall, 1988; Wellman & Guila, 1999a, 1999b). To define virtual community by interaction, a researcher determines what kinds of exchanges are occurring among classmates, how regular and frequent they are, what the tone and level of intimacy are, and what the potential topics are (e.g., “work-related” or “friendship”-based). These data are used to create maps of how the students interact, allowing the researchers to derive models of how information and other resources flow through the group.

The methods and models referenced above focus on determining whether or not a group of people exhibits externally defined indicators of community. Puddifoot (1996) calls into question such quantification: “It is not apparent whether community identity can be established in any empirically objective way, or indeed whether this should even be the goal” (Puddifoot, 1996, p. 328). There is a construct, well known in the community psychology literature, of “psychological sense of community” (PSOC) (Glynn, 1981; McMillan, 1976; McMillan & Chavis; 1986, McMillan, 1996). Simply put, this is the individual’s perception of whether or not she belongs to a community, and it is this construct that forms the basis of our investigation.

## **McMillan & Chavis’ Psychological sense of community**

In their seminal 1986 article, McMillan and Chavis sought to describe a sense of community and offered four criteria necessary for any acceptable definition. Any definition, they said, must be explicit and clear. It must be concrete, with its parts identifiable. Finally, say McMillan and Chavis, it must represent the “warmth and intimacy implicit in the term;” (p. 9) and provide a dynamic description of the development and maintenance of the experience. Their model has formed the basis of much of the work done in the field of community psychology, but has not had a noticeable impact in the world of education.

The PSOC, as its name implies, is based in the idea that many of the benefits ascribed to community come from an internal sense of community, irrespective of any externally-observable characteristics about the group in

question. While designed with place-based neighborhoods in mind, McMillan and Chavis assert that their definition of sense of community will apply equally to both place-based and non-place-based communities.

The model entails four elements (Membership, Influence, Needs, and Emotional Connection), each of which has a series of sub-characteristics. These elements, shortened to the acronym MINE throughout the rest of this paper, are described in detail below.

## **Membership**

Membership deals not only with who is in or not in a community, but with the sense of safety that accompanies such delineation. The ability to identify another member of a community allows one to better determine how to spend resources and with whom to feel comfortable. Integral to the idea of membership is the concept of boundaries. It is perhaps just as important to know who is not in the community as it is to know who the members are.

Boundaries can be created and enforced in many ways, including a group's use of language, styles of dress, and rituals. Gang members, for example, are able to tell at a glance if they are facing a friend or foe by looking at the person's colors. In this case, even more than most, the creation and maintenance of boundaries, as demonstrated by dress or rites, is a protection against external threat. Similarly, a common symbol system aids in creating and maintaining group boundaries. These symbols combined create a social convention that again delineates the "us" versus "them." Symbols may operate at the group level (black leaders using Black Power and clenched fist), the neighborhood level (name, landmark, logo, architectural style), or national level (holidays, flag, language, currency).

Safety, especially emotional safety, is embodied in the idea of security in one's community. Established boundaries provide structure and security, protecting group intimacy. In many cases, such support is emotional in nature, but in the case of gangs or warring factions, the security is physical; for collectives and cooperatives, the security can be financial.

The expectation that one fits the group and is accepted by the group is a sense of belonging and identification. The member feels he has a place there, and is willing to make sacrifices for the group. The member identifies with the group, which is reflected in reciprocal statements such as "This is my group" or "I am part of this community."

Personal investment also contributes to an individual's feeling of group membership and feelings of belonging. McMillan (1976) asserted that working for membership will provide the feeling that one has earned a place in the group, and that consequently, this personal investment will make the membership more valuable.

## **Influence**

Influence is the second overarching element of the psychological sense of community. Influence is bi-directional: in order to be attracted to the group, an individual must have the potential of influencing the group. The reverse case — the ability of the group to influence its members — is crucial to maintaining cohesiveness. These seemingly opposite forces do appear to work simultaneously, indeed, in concert. Note that influence often operates independently of positions of authority.

An important aspect of influence is the idea of consensual validation, which assumes that "people possess an inherent need to know that the things they see, feel, and understand are experienced in the same way by others" and people will go to great psychological and emotional lengths to reassure themselves that they are not crazy (McMillan & Chavis, 1986, p. 11). One cause, then, of group conformity, is the pressure on the individual to experience harmony with the group's world view. Again, this pressure can move from the individual into the group as well as being imposed by the group on the individual, so that the group is "operating to consensually validate its members as well as to create group norms" (McMillan & Chavis, 1986, p. 11).

## **Integration and fulfillment of needs**

The third element of the psychological sense of community is the integration and fulfillment of needs, most commonly encompassed by issues of reinforcement. Obviously, the individual's association with the group must be rewarding for the members. In many cases, a reinforcing element is just the status of being a member of that group. The benefit of being a member of the "in crowd" is simply association with that group.

Communities are also strengthened by group accomplishments. Simply stated, successes associated with group activities bring members closer together. McMillan and Chavis assert that competence is personally attractive and that people will gravitate towards groups and other people that offer the most reward.

A third way in which need fulfillment is given direction is through the concept of shared values. People with shared values come together and find they have similar goals, priorities, and needs, and is more easily able to focus resources on issues that speak to those values. This encourages the belief that, as a group, they are better able to fulfill their needs in a continual, mutually-beneficial way. In this case, it is shared values that act as an “integrative force for cohesive communities” (p. 13). Note, however, that a group with a strong sense of community in which members do not necessarily have identical goals and priorities will still work together to fulfill all members’ needs.

### **Shared emotional connection**

The final component of the psychological sense of community is a shared emotional connection, which is based, in part, on a shared history. McMillan and Chavis point out that it is not necessary that all group members have participated in the history in order to share it, but they must identify with it.

To share a connection with others, of course, presupposes interaction with them. The “contact hypothesis” asserts that the more people interact, the more they are likely to become close. The quality of interaction is also important, in that positive experiences create greater bonds; as was noted earlier, group success creates cohesion.

Sharing emotional events is crucial in creating a sense of connection. The “shared valent event hypothesis” states that the more important the shared event is to the people involved, the greater the community cohesion. Groups who survive a crisis together feel an increased bond (e.g., war veterans). Closure to events is an important part of community unity; if the group’s tasks are unresolved and interaction is ambiguous, the cohesion will suffer.

Investment in the community “determines the importance to the member of the community’s history and current status” (McMillan & Chavis, 1986, p. 14). People who expend time and energy on projects will feel more emotionally involved in their outcome.

Finally, various types of intimacy affect the shared emotional connection. Intimacy is a type of investment: the emotional risk one takes with other members of the group can affect (and be affected by) one’s sense of community.

### **Applying the PSOC framework**

Working from this theoretical base, Chavis, Hogge, McMillan & Wandersman (1986) took these four major categories and used them to derive an instrument to measure PSOC in an individual, the Sense of Community Index (SCI).. The SCI, and hence the PSOC, have been used to describe both place-based (geographical, e.g. a neighborhood) and non-place-based (relational, e.g., an ethnic group) communities. McCarthy (1990) and Pretty (1990) validated the SCI for the undergraduate university community. Pretty has used the instrument in both the corporate world (1991) and with adolescents (1994).

In 1996, Sonn (1996) developed an “open response format interview schedule” to assess the four elements of the sense of community framework, then conducted semi-structured interviews (lasting 25-50 minutes) with 23 participants (p 420). He then used the elements of the psychological sense of community to frame themes emerging from the interview data, providing evidence that the PSOC model has construct validity in this environment.

Despite its preponderant use in the field of community psychology, only a single reference to this model in education was found: dissertation work by Chao (1999). In the next section, use of the theory underlying the PSOC to examine communications among members of an online distance education program is discussed.

## **Methods**

### **Context**

The research proposed focuses on a particular program, a master’s degree in educational technology offered by a large, Midwestern university. The Education Technology Online Master’s (ETOM) is a three-year, cohort-based program designed to give working professionals an opportunity to earn an M.S. in educational technology. The overriding concerns center on (a) the ability to maintain high standards of academic quality at a distance in a highly accessible format, and (b) economic feasibility and sustainability of the program.

The ETOM seeks to build on the success and structure of the on-campus master’s program, while taking into account the needs of full-time employees. The coursework is essentially the same as that on campus; project-

based with a great deal of group work, some individual development projects, a substantial amount of writing, and a mastery-based assessment process. These characteristics are considered essential by the faculty of the department, and frame the challenges of a distance program along both pedagogical and economic dimensions.

The ETOM is set up as a cohort; each group of students will travel through the three-year program together. While not all students will take all the same courses, the required courses will be taken with the same group of people in an effort to instill a sense of community and trust.

## **Participants**

Participants for this study are distance students drawn from the online master's program previously described. Researchers received permission to view postings and chat transcripts from 15 of the 16 students in the cohort.

All participants hold full-time jobs, their positions split roughly equally among K-12, higher education, and the corporate world. Geographically, they are spread across three time zones. They range in age from 25 to 55. Nine of the seventeen are women. As individuals who chose to pursue an online degree in educational technology, these students all had above-average technical skills.

## **Data sources and collection**

All data collected were the products of a one-semester online course offered during the Fall 2000 semester. Data were collected primarily from two sources. First is a series of online chats that took place throughout the semester, held most Wednesday nights at 8:00 and lasting between 1.5 and 2 hours. These weekly chats were the only scheduled "real-time" interaction the students had with the instructor, and were designed to give the students access to the professor to discuss issues surrounding the content, assignments, and due dates.

Attendance at the chats (after an initial time-zone mix-up) was excellent at the beginning of the semester and grew spottier as time went on. Roughly two-thirds of the way through the semester the instructor discontinued these whole-group chats because so few people were attending. They were reinstated at the request of a vocal minority, and attendance for the rest of the semester hovered around 7-8, or half the students. In total, there were 11 chat sessions comprising over 1000 separate entries.

The second source of data was asynchronous postings to the whole-group spaces of the course's web-based conferencing system. These were open throughout the semester, but the vast majority of the almost 200 postings in the conferences took place in two distinct threads dealing with end-of-project "lessons learned". All these data were collected from the electronic systems and reformatted for easier reading and for import into nVivo™.

## **Data analysis**

Data analysis began with an examination of transcripts from both the asynchronous conference and the real-time chats. Each entry was examined (in context) for communication beyond simple task-oriented interaction; these were assigned a low-level code to denote the type of utterance. The unit of analysis, then, was not specifically limited to a whole phrase or even sentence; units ranged in size from a short phrase to several sentences.

Data were coded until the list of codes stabilized (at about 29 of these low-level categories). The entire data set was imported into nVivo™ and coded by the researchers; codes were often merged or added to the list as necessary. Finally, already-coded data were re-checked to make sure the definitions of codes hadn't drifted during this process.

Since the concern of this study is the students' sense of community, all comments made by the instructor were ignored (although responses directed at the instructor were, of course, included). Also ignored were those comments that involved purely giving and receiving course-related information (e.g., asking the instructor to define a term), answering a simple, information-oriented question (such as "What were we supposed to read this week?"), and in general, those questions and the resulting exchanges that were so task-oriented as to give no insight into the community feelings codified in the MINE framework. The researchers' interpretation of McMillan and Chavis led to the conclusion that such purely functional transactions are of little value when looking for evidence of PSOC.

In the end, the original 29 codes had been modified and reduced to a list of 22 different types of comments that seemed to relate, in some way, to issues represented in the sense of community model driving the analysis. Armed with this list of codes, the researchers returned once more to the PSOC theory. Guided by McMillan and Chavis (1986), and with ideas further refined from McMillan (1996) and Chao (1999), the data were categorized



into the four major components of PSOC (membership, influence, fulfillment of needs, or shared emotional connection). The full results of this categorization can be seen in tables 1 through 4.

### Findings and interpretation

Of the original 200 posts in the asynchronous conference and almost 1000 comments made in the chats (together equating to roughly 120 printed pages), 187 utterances were coded into at least one of the 22 relevant categories. These broke down into the four MINE categories as indicated in each of the following sections.

### Membership

Themes Indicating Membership	Number
Indication this is a safe space	2
Offer of help /information without request	3
Shared symbol system	1
Basic verbal support	34
Humor of a personal nature	37
Reference by name	18
Member check	4
General question implying a request for support	2
<b>TOTAL</b>	<b>101</b>

Table 1: Themes indicating Membership

Membership subsumes ideas of boundaries, language, and other representations of a common symbol system, and a sense of belonging to the group and the emotional safety that comes from that group identification. These ideas manifested themselves in four broad categories.

In the case of this cohort, boundaries were artificially created and maintained by the enrollment structures. Only people enrolled in the program (and the professors and staff) had any contact with the group as a whole, so there was really no need to either delineate or enforce boundaries.

Working in an online format makes certain demands on students with respect to communication, but it also provides opportunities for the group to adopt certain shared symbols. The use of emoticons (“smilies,” especially) was very common, and a few students had their own symbols that they attempted to share with the group (further discussed in the section on influence). With the exception of the construct “\*see\*” to indicate online presence (“I’ll \*see\* you tomorrow”), non-standard symbols were not adopted by the entire group.

A few themes emerged that suggested that the students felt a certain degree of emotional and intellectual safety in the group. One student implied that she felt safe in the community and with respect to the instructor: “I can’t believe I’m admitting this to the teacher, but I feel much better now that I’ve learned what I can ignore”. One reason perhaps that people feel emotional safety in their group is that support is available. We infer that asking a question implying support: (“Is everyone surviving?”) or giving basic verbal support (“I’ll second that ;-)”) demonstrates the feeling is that someone is available to provide the asked-for support. Thirty-four instances of basic verbal support were found. McMillan and Chavis claim that use of humor may also be an indication of emotional safety that shows the speaker is confident in her ability to connect with her peers on an emotional level. There were 37 uses of humor in the data set.

The feeling that one belongs and is accepted by the group can manifest itself in a few ways. Riger (1981) cites social bonding indicators that, for co-present communities, include the ability to identify neighbors and their children. In the studied environment this can be demonstrated by individuals’ referring to each other by name (“Grace—I agree”). The use of names aids in feelings of belonging in that it creates intimacy. Students referred to each other by name 18 times.

Overall, more than 100 of the 187 coded utterances were related to the Membership dimension. This makes it by far the most often expressed aspect of community.

### Influence

Themes Indicating Influence	Number
Voice minority opinion	9

Attempt to build/enforce symbol system	1
Ask for/give neutral/popular opinions	17
Ask for clarification	2
<b>TOTAL</b>	<b>29</b>

Table 2: Themes indicating Influence

As was mentioned previously, influence is bi-directional. Although individuals must have the potential to influence the group, the group’s cohesiveness is contingent on its ability to influence members.

Although the role of an assigned instructor is different from that of an emergent an instructor can be considered an authority figure with whom structures (and hence influence over the class) can be negotiated. The bi-directionality of such influence was first illustrated at the face-to-face orientation. The instructor had mandated a Friday night due date for weekly assignments, but then noted that she wouldn’t look at them until Monday. The students pointed out that most of the time they had free to work on the course was on the weekend, and so negotiated a Sunday night due date. This set the stage for later debates about due dates and assignments, immediately showing students that they had some power over the course and hence should be less hesitant to invest in the group.

While the existence and use of a shared symbol system is an indication of membership (via explicated boundaries), an attempt to create or enforce such a system is a matter of influence. Some students used acronyms and constructs common in online chat sessions, not all of which were taken up by the larger group. In one case, the student explicated her use of actions between asterisks to describe asides (e.g., \*looks around for help\*). This is way of expressing oneself that is standard and common in many chat rooms, but it was new to the students with more limited online communication experience and was never adopted by the rest of the group.

One of the most powerful indicators of influence is expressing a minority opinion. In this case, the speaker must take the risk of “going against the grain” and taking a stand opposite that of the group, or at least, the opinions expressed thus far. The level of risk perceived by the speaker is inherent in his preface to the divergent opinion: “If I could respectfully disagree and restate I believe them to be at least equal in a highly complex subject area.” We found fewer than 10 examples of students expressing a minority opinion.

If expressing a minority or divergent opinion is a strong indicator of sense of community; a related indication of influence is trying to elicit or giving neutral or popular opinions: “Does everyone else agree with this view?”

A final indicator of influence that emerged from the data was when someone simply asked for clarification. This shows a willingness to be influenced by another individual: at the least, it indicates some level of investment in what the other person is expressing: “I’m intrigued by this question. Explain what you are thinking a little more.”

Twenty-nine of the total utterances were related to influence. This represents roughly one-sixth of the total, and most of these were related to neutral or popular opinions.

### Needs

Themes Indicating Integration and Fulfillment of Needs	Number
Ask for understanding or apologize	4
Request basic or immediate info	22
Exhibit experience/expertise	9
Express thanks	8
Be self-effacing/express doubts hoping for support	6
Express frustration	1
Request elaboration	1
<b>TOTAL</b>	<b>51</b>

Table 2: Themes indicating Integration and Fulfillment of Needs

According to McMillan and Chavis, an individual seeks out and maintains membership in a group because the group somehow fulfills his needs. Many of the utterances in this category are basically indicators of reinforcement and support, either expressing a need, or offering to fulfill another’s need. For example, when someone asks for understanding or apologizes (“Sorry, I lost my connection”) she is assuring the group of her continuing membership and indirectly requesting validation of the membership/relationship in spite of the error or violation.

On a more concrete level, some needs are not emotional in nature but are related to resources. As a member “in good standing” of a particular group, an individual has access to the expertise and intellectual resources of the group. It requires a certain level of emotional security within the group to ask for help (“I can’t get the Participants

list to show anyone”), or to show unfamiliarity and ask for information that appears to be common knowledge: “I hate to admit my ignorance, but what is IRC?”.

The other side of the needs fulfillment coin is the offer of help, either solicited or unsolicited. Volunteering useful information to the group — especially in the absence of a request for such information — fulfills a number of roles, including exhibiting experience or expertise that other members will find attractive: “Karl and I were looking at AOL, and think it will speed things up a little.” It’s also an indication that the speaker feels it is worth her time and effort to help out another member of the group. This could be an indication that the speaker believes mutual success is linked to helping behaviors.

Finally, there is the need for external validation of suffering: the desire to complain to someone who will understand. This powerful attribute of community is used explicitly in support groups and similar counseling situations, but is no less important to a group that occasionally needs a safe space and sympathetic ears for venting: “We were dying in our group chat!”

Fifty-one of the total coded utterances were related to fulfillment of needs. However, almost half of these were simple requests for basic information.

### Shared emotional connection

Themes Indicating Shared Emotional Event/Connection	Number
References to orientation	2
Ask about shared history	2
Express happiness being part of group	2
<b>TOTAL</b>	<b>6</b>

Table 4: Themes Indicating Shared Emotional Event/Connection

With respect to shared emotional connection, we found three distinct themes: asking about shared history, expressing happiness at being part of the group, and making references to the pre-program orientation, the cohort’s first shared event, and their only face-to-face event to date: “I think that [orientation] was real important for retaining people, keeping people on the program, so that they felt some sort of commitment now to this group.”

Bonds, as they relate to shared experiences, seem to correspond to the level of emotion involved rather than whether or not the experience was a negative one. Shared positive experiences can create strong bonds, but an increased bond is also reported by groups who survive a crisis. In this case, the students experienced a 4-day face-to-face orientation that was intentionally structured to have a high-intensity “boot camp” feel. Students immediately got down to work, worked, ate, and lodged together, and had four very full days of togetherness and things they had to accomplish. The orientation fits into the shared valent event hypothesis, which states that the more important the shared event is to the people involved, the greater the community cohesion. The final indicator of a shared emotional connection is a student expressing happiness at being part of the group; there were two utterances on this theme. As can be seen in table 4, only six of the original 187 utterances spoke to the shared emotional connection.

### Discussion

As can be seen from the four tables, not only was there little evidence of PSOC in general (only 187 coded utterances in over 120 pages of text), but these did not represent all four areas of community well. The data show a paucity of evidence of a shared emotional connection (only six examples), and more than half of these coded passages spoke to issues of membership.

Perhaps more important, the majority of these utterances are in forms that could be easily construed as not indicating community so much as polite conversation. Roughly half of the coded data refers to three items: humor, giving basic verbal support, and simple questions asking for simple information. While these items certainly represent their respective characteristics of community, they seem to be in a form that could be incorporated into the pattern of conversation, mitigating their power as indicators. It is also the default for people who don’t know each other well, who don’t feel safe with each other, and who treat each other as strangers.

Given these findings—lack of coverage and the prevalence of coded items that may be primarily indicative of simple etiquette—we are hesitant to speak about any substantial sense of community in this group. The discussions studied had a task focus, lacking many of the social cues one would expect to see in a group with a high PSOC. Why was there so little evidence of community? While there are various limitations to the study (discussed below) that could account for the failure to find an existing community, the first and most obvious explanation is that substantial evidence of community simply isn’t there to be found. Another issue may be the timeline — one

semester. While some articles speak about developing community within the span of a single course (Eastmond, 1995; Hill & Raven, 2000) it simply may not be long enough using this type of analysis.

As indicated, there was also a noticeable focus purely on the tasks under discussion. This is partially an outcome of the communications available for analysis. Given a limited time in which students could discuss course assignments and feedback with the instructor, it is not surprising that little of it would be spent providing the social cues and debates that would indicate PSOC.

### **Limitations**

This study uses “found data” — data collected after the course and analyzed long after its creation. While there are complete transcripts of the chat sessions and the contents of the asynchronous discussion, the data were analyzed without the insight into changing tensions and attitudes that analysis during the course itself may have provided. A future study will take place concurrently with the course itself, allowing for the exploration of issues as they arise.

This study also suffers from limited data access. While we had full access to the chats and asynchronous conferences, no interviews were completed and therefore it was not possible to follow up on interesting points. Data collected by colleagues speak to the importance of the orientation, which the current data set only begins to suggest.

Post-course communication with some students indicates the interactions that would have been found most interesting took place between individuals via personal email. Not only are researchers unlikely to be given access to personal email, but there is a strong sentiment that it is inappropriate to even ask for it. Students need at least one avenue of communication that they feel is secure.

### **Future work**

Data analysis is hampered by the lack of a rubric for determining what makes a particular utterance a “strong” one. While the researchers don’t rely heavily on counting utterances to gain insight into the class, we do feel we need a way to indicate that saying someone’s name is not as powerful an expression of sense of community as expressing a minority opinion. The researchers hope to develop such a set of criteria and apply it to data from these same students in the upcoming semesters of their degree program.

Studying these new courses using data collection methods such as interviews and surveys will help to the researchers accomplish two goals. First, it may be possible to refine and validate the PSOC model for use in qualitative research of an online cohort, perhaps using the SCI itself to validate our analyses. Second, albeit may eventually be possible to correlate specific course structures and salient events to changes in the PSOC. This information can be used to inform the second round of design for the online program and, hopefully, have an impact on attrition and student satisfaction.

### **Conclusions**

The psychological sense of community, as defined in McMillan and Chavis’ (1986) model, appears to be a meaningful, well-established and powerful tool for the rigorous investigation of community. The model offers a lens through which to explore how a group of students perceives itself. Application of the sense of community to qualitative methods is in its infancy, but this model lends itself well to this type of investigation. Future work will help determine if the model is able to offer insight into real-world applications of course design and structures that may, in turn, affect attrition rates and student satisfaction.

### **References Cited**

- Altman, I. (1975). *The environment and social behavior: Privacy, personal space, territory, crowding*. Monterey, CA: Brooks.
- Baker, P., & Moss, K. (1996). Building Learning Communities through Guided Participation. *Primary Voices K-6*, 4(2), 2-6.
- Bauman, M. (1997). Online learning communities. Paper presented at the Teaching in the Community Colleges Online Conference.
- Bielaczyc, K., & Collins, A. (1999). Learning Communities in Classrooms: Advancing Knowledge for a Lifetime. *Nassp Bulletin*, 83(604), 4-10.

- Boehmer, R. F., & Waugh, M. L. (1997). Developing a Distributed Learning Community: Undergraduate Education Majors Use the Internet To Engage in Early Teaching Experiences in Biology. *Journal of Computing in Teacher Education*, 13(2), 7-15.
- Brower, A. M., & Dettinger, K. M. (1998). What "Is" a Learning Community? Toward a Comprehensive Model. *About Campus*, 3(5), 15-22.
- Brown, K. M. (1996). The role of internal and external factors in the discontinuation of off-campus students. *Distance Education*, 17(1).
- Bruckman, A. (1996). Finding one's own space in cyberspace. *Technology Review*, 99(1), 48-54.
- Chao, C.-C. (1999). Sense of community and meaningfulness in an on-line course for language teachers. Indiana University: unpublished manuscript.
- Chavis, D. M., Hogge, J. H., McMillan, D. W., & Wandersman, A. (1986). Sense of community through Brunswick's lens: A first look. *Journal of Community Psychology*, 14, 24-40.
- Cox, B. (1997). Evolving a distributed learning community. Retrieved March 11, 2001, from the World Wide Web: <http://www.virtualschool.edu/cox/OnlineClassroom.html>
- Cross, P. K. (1998). Why Learning Communities? Why Now? *About Campus*, 3(3), 4-11.
- Dille, B., & Mezak, M. (1991). Identifying predictors of high risk among community college telecourse students. *The American Journal of Distance Education*, 5(1), 24-35.
- Donath, J. S. (1999). Identity and deception in the virtual community. In P. Kollock (Ed.), *Communities in Cyberspace* (pp. 29-59). London: Routledge.
- Eastmond, D. V. (1995). *Alone but Together: Adult Distance Study through Computer Conferencing*. Cresskill, NJ: Hampton Press, Inc.
- Everhart, R. L. (1999, April, 1999). Creating Virtual Communities. *Syllabus*, 12, 12-16.
- Haythornthwaite, C., Kazmer, M., Robins, J., & Shoemaker, S. (2000). Making Connections: Community among Computer-Supported Distance Learners. Paper presented at the ALISE 2000, San Antonio, TX.
- Hill, J., R., & Raven, A. (2000). Creating and Implementing Web-based Instruction Environments for Community Building. Paper presented at the AECT, Denver.
- Hill, P. (1985). The Rationale for Learning Communities and Learning Community Models (ED309818).
- Kember, D. (1995). *Open Learning Courses for Adults: A Model of Student Progress*. Englewood Cliffs, NJ: Educational Technology Publications.
- Kim, A. J. (2000). *Community Building on the Web*. Berkeley, CA: Peachpit Press.
- Kollock, P., & Smith, M. A. (1999). Communities in Cyberspace. In P. Kollock (Ed.), *Communities in Cyberspace* (pp. 3-28). London: Routledge.
- Lave, J., & Wenger, E. (1991). *Situated learning : legitimate peripheral participation*. Cambridge [England] ; New York: Cambridge University Press.
- Lawrence, R. L. (2000). Building a Learning Community. Retrieved, from the World Wide Web: <http://www.nl.edu/ace/Resources/Documents/LearnCommunity.html>
- McCarthy, M. E., Pretty, G. M. H., & Catano, V. (1990). Psychological Sense of Community and Student Burnout. *Journal of College Student Development*, 31(May), 211-216.
- McMillan, D. W. (1976). Sense of community: an attempt at a definition. George Peabody College for Teachers, Nashville, TN: unpublished manuscript.
- McMillan, D. W. (1996). Sense of Community. *Journal of Community Psychology*, 24(4), 315-325.
- McMillan, D. W., & Chavis, D. M. (1986). Sense of Community: a definition and theory. *Journal of Community Psychology*, 14, 6-23.
- Morgan, C. K., & Tam, M. (1999). Unravelling the Complexities of Distance Education Student Attrition. *Distance Education*, 20(1), 96-108.
- Nippert, K. (2000). Influences on the educational degree attainment of two-year college students. *Journal of College Student Retention Research, Theory, and Practice*, 2(1), 29-40.
- Palloff, R. M., & Pratt, K. (1999). *Building Learning Communities in Cyberspace*. San Francisco: Jossey-Bass.
- Pike, G. R. (1997). The Effects of Residential Learning Communities on Students' Educational Experiences and Learning Outcomes during the First Year of College. ASHE Annual Meeting Paper (ED415828).
- Preece, J. (2000). *Online Communities*. Chichester: John Wiley & Sons.
- Pretty, G. (1990). Relating psychological sense of community to social climate characteristics. *Journal of Community Psychology*, 18, 60-65.
- Pretty, G., Andrews, L., & Collett, C. (1994). Exploring adolescents' sense of community and its relationship to loneliness. *Journal of Community Psychology*, 22, 346-358.

- Pretty, G., & McCarthy, M. (1991). Exploring psychological sense of community among women and men of the corporation. *Journal of Community Psychology*, 19, 351-361.
- Puddifoot, J. E. (1996). Some Initial Considerations in the Measurement of Community Identify. *Journal of Community Psychology*, 24(4), 327-336.
- Riger, S., & P.J., L. (1981). Community ties and urbanites' fear of crime: an ecological investigation. *American Journal of Community Psychology*, 9, 55-66.
- Schwier, R. A. (2001). Catalysts, Emphases, and Elements of Virtual Learning Communities: Implications for Research and Practice. *Quarterly Review of Distance Education*, 2(1), 5-18.
- Selznik, P. (1996). In search of community. In W. Jackson (Ed.), *Rooted in the Land: Essays on Community and Place* (pp. 195-203). New Haven: Yale University Press.
- Shapiro, N. S., & Levine, J. H. (1999). *Creating Learning Communities: A Practical Guide to Winning Support, Organizing for Change, and Implementing Programs*. Jossey-Bass Higher and Adult Education Series (ED434624).
- Sonn, C. C., & Fisher, A. T. (1996). Psychological Sense of Community in a Politically Constructed Group. *Journal of Community Psychology*, 24(4), 417-430.
- Want, H., & Grimes, J. W. (2000). A systematic approach to assessing retention programs: identifying critical points for meaningful interventions and validating outcomes assessment. *Journal of College Student Retention Research, Theory, and Practice*, 2(1), 59-68.
- Wellman, B. (1979). The Community Question. *American Journal of Sociology*, 84, 1201-1231.
- Wellman, B. (1999). The network community: An introduction to networks in the global village. In B. Wellman (Ed.), *Networks in the Global Village*. Boulder, CO: Westview Press.
- Wellman, B., Carrington, P., & Hall, A. (1988). Networks as personal communities. In S. D. Berkowitz (Ed.), *Social Structures: A Network Approach* (pp. 130-184). Cambridge: Cambridge University Press.
- Wellman, B., & Guila, M. (1999a). Net Surfers Don't Ride Alone: Virtual Communities as Communities. In P. Kollok (Ed.), *Communities in Cyberspace* (pp. 167-194). London: Routledge.
- Wellman, B., & Guila, M. (1999b). The network basis of social support: A network is more than the sum of its ties. In B. Wellman (Ed.), *Networks in the Global Village*. Boulder, CO: Westview Press.
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge, U.K.: Cambridge University Press.
- Wilson, B., & Ryder, M. (1996). *Dynamic Learning Communities: An Alternative to Designed Instructional Systems* (ED397847).

## Information Literacy in Higher Education: Is There a Gap?

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### Abstract

*Before a student can become information literate, he or she must be taught information literacy skills. Higher education cannot produce information literate students if it does not first have information literate teachers. The purpose of this needs assessment was to investigate the current and optimal levels of information literacy among the faculty members at South Georgia College. A few key questions this assessment answers are: What is the current state of information literacy among SGC faculty? What is the optimal state of information literacy among SGC faculty? For those faculty members who are information literate, what technology are they using to demonstrate information literacy in their instruction? For those faculty members who do not use technology for gathering and presenting data in their course instruction, what are the reasons for why they do not? How can those who are not information literate be brought up to proficiency? How can those who are information literate help those who are not?*

*South Georgia College is a two-year public college under the University System of Georgia. Average student enrollment for SGC is between 1,200 - 1,250 students. There are 41 full-time faculty members who teach at the college. Only full-time, teaching faculty members from the major academic divisions on campus were considered as subjects for research. Each faculty member was asked to complete a closed-ended survey of ten questions to determine the overall information literacy of SGC's faculty based upon qualitative analysis. Then, six faculty members, two from each of the three major divisions on campus, were randomly selected and asked to participate in an in-depth interview to provide the qualitative analysis of the needs assessment.*

*The two instruments used to conduct the research were in-depth interviews and a closed-ended survey. The closed-ended survey asked objective, general questions concerning the perceived current and optimal levels of information literacy among SGC faculty, the needs of those who are information literate and the needs of those who are not, and the causes for why a gap exists between the current and optimal levels of information literacy among the faculty. The in-depth interviews were conducted after the surveys were tallied. The interviews focused on gathering subjective data from participants. The interview questions dealt mainly with measuring the gap between the current and optimal levels of information literacy among SGC faculty, identifying areas of concern for those faculty who are using technology as well as for those who are not, and soliciting support from those faculty members who are information literate to help bring those who are not up to task.*

*From the data collected, on average, the faculty at SGC were found to be performing at an acceptable level of information literacy. Both the survey and interview data supported this. However, several intriguing results surfaced, as did a few problems in the design of the instruments. The survey produced the finding that faculty members still prefer traditional printed resources for gathering information, probably because most still use lesson plans that were developed before electronic resources were popular or available. However, the first place faculty would look today for finding supplemental information is not traditional printed resources but electronic resources. The survey findings also revealed that the majority of participants do not know the laws and ethical standards associated with copyright on the Internet. Furthermore, most faculty members surveyed believed that even if specific technology were made available, a teacher would continue to rely on traditional means of information gathering. The greatest design flaw in the survey was that several participants could not speculate on general questions that asked them to rate the information literacy of all faculty. Academic Freedom is highly upheld in post secondary education; thus, participants did not want to guess at what their colleagues did in their classrooms because they truly do not know. The instrument designer did not consider this at the time the survey was created.*

*The most surprising issue revealed by the in-depth interviews was that most participants were able to distinguish between technology literacy and information literacy, even though the interviewer did not*

*discuss technology literacy. A majority of the participants agreed that a teacher's use of technology in course instruction does not necessarily reflect his or her knowledge of information literacy. The in-depth interviews were not without flaw either. Only four of the Information Literacy Standards used to rate participants' responses were addressed in the interview questions. This was a huge oversight on behalf of the instrument designer.*

*In conclusion, several steps could be taken to help faculty members become even more information literate. One possible solution was addressed in the in-depth interview results. Several subjects said that on-campus conferences and workshops involving technology used to gather information would certainly help them. An inexpensive solution would be to hold periodical teaching circles in which a group of teachers from various disciplines convene once a month to discuss how they gather information and use it in their course instruction. This would be the most feasible solution to the problem. A third solution would be for the administration to promote the scholarship of teaching, which would include the exercise of information literacy skills. Through course instruction improvements, faculty members can begin to vie for specific grants and fellowships that reward those who excel in the scholarship of teaching.*

## **Introduction**

Several college faculty members have incorporated technology and various forms of up-dated information systems into their course instruction. However, for every faculty member who has up-dated his or her delivery methods, there is a faculty member who continues to utilize the methods associated with stale tradition. Interactive web pages, PowerPoint slides, and the Internet are specific technologies that faculty members are - or are not - using in lieu of textbooks, chalkboards, and printed materials to present new ideas on how to retrieve and deliver information to their students. The resulting gap is very clear, some faculty members are quite information literate in terms of electronic resources and some are not; nevertheless, all should be information literate to a certain extent.

Located in Douglas, Georgia, South Georgia College became part of the University System of Georgia in 1932. One of its primary missions is to promote the scholarship of teaching via the latest technology and instructional designs available. Within the past three years, two computer-based classrooms have been added to the campus to help promote teaching with the use of technology. Today, SGC has a total of three model classrooms used by a variety of faculty members to teach their subjects, such as psychology, history, and physics. Average student enrollment for is between 1,200 - 1,250 students. There are 41 full-time faculty members who teach at the college.

The Information Literacy Competency Standards for Higher Education, approved by the Association of College and Research Libraries in January 2000, provides a list of standards, performance indicators, and outcomes that define what the information literate student must be capable of achieving. The information literate student must be able to analyze what information is needed, as well as what information is and is not appropriate for the purpose involved. He or she then must know how to retrieve the information either individually or with a group for accomplishing a specific purpose (ACRL, 2000). However, before the student can become information literate, he or she must be taught information literacy skills. That is where the faculty member's information literacy comes into question. Higher education cannot produce information literate students if it does not first have information literate teachers (Roth, 1999).

Not only will this needs assessment be beneficial to the specific clients involved, it will also contribute to research within the scholarship of teaching. Similar two-year institutions can use this study as an example for conducting research at their own institutions. They can implement the recommendations from the results of this needs assessment at their institutions without having to conduct a formal needs assessment of their own. Finally, several new questions and needs emerged from the results of this research, such as the need for faculty members at South Georgia College to become better aware of the ethics and copyright laws associated with using materials from the Internet for instruction. The conductors of this needs assessment could certainly continue their research in more depth at South Georgia College; other assessors could continue this type of research at their schools as well.

A few key questions this assessment answers are: What are the standards that will determine who is information literate and who is not? What is the current state of information literacy among SGC faculty? What is the optimal state of information literacy among SGC faculty? For those faculty members who are information literate, what technology are they using to demonstrate information literacy in their instruction? For those faculty members who do not use technology for gathering and presenting data in their course instruction, what are the reasons for why they do not? How can those who are not information literate be brought up to proficiency? How can those who are information literate help those who are not?

## **Methods**



South Georgia College consists of 41 faculty members from various academic backgrounds. Only full-time, teaching faculty members from the major academic divisions on campus were considered as subjects for research. All academic faculty members were asked to complete a survey. Six faculty members, two from each of the four major divisions on campus, were randomly selected and asked to participate in an interview. Those divisions included the Division of Humanities and Learning Support, Division of Business and Social Sciences and Division of Science and Mathematics.

The two instruments used to conduct research were in-depth interviews and a closed-ended survey. The closed-ended survey consisted of general questions designed to validate the issues, needs and causes of the needs assessment. In other words, the survey asked objective, general questions concerning the perceived current and optimal levels of information literacy among SGC faculty, the needs of those who are information literate and the needs of those who are not, and the causes for why a gap exists between the current and optimal levels of information literacy among the faculty. The in-depth interviews were conducted after the surveys were tallied. The interviews focused on gathering subjective data from participants. The interview questions dealt mainly with measuring the gap between the current and optimal levels of information literacy among SGC faculty, identifying areas of concern for those faculty who are using technology as well as for those who are not, and soliciting support from those faculty members who are information literate to help bring those who are not up to task.

The procedures for developing and conducting research consisted of several steps. First, permission from the Vice President of Academic Affairs to conduct research on the campus of South Georgia College was obtained. Each interview subject signed a written consent form before participating in this study. Finally, permission from the VSU Institutional Review Board for the Protection of Human Subjects in Research and Research Related Activities was obtained before carrying out this needs assessment.

Next, the standards used to represent the optimal level of information literacy among SGC faculty were developed. These standards were adopted from the Association of College and Research Libraries (ACRL) Information Literacy Competency Standards for Higher Education (ACRL, 2000). Although these standards and performance indicators are relative to the students of higher education, they also apply to teachers of higher education since it is the teachers who must teach the students how to be information literate. Thus, the Faculty Information Literacy Standards for assessing the optimal level of information literacy among SGC faculty were designed from those proposed for students by the ACRL. Those standards include the following - Standard I: The information literate teacher determines the nature and extent of the information needed; Standard II: The information literate teacher accesses needed information effectively and efficiently; Standard III: The information literate teacher evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system; Standard IV: The information literate teacher, individually or as a member of the a group, uses information effectively to accomplish a specific purpose; and Standard V: The information literate teacher understands many of the economic, legal, and social issues surrounding the use of the information and accesses and uses information ethically and legally. The specific objectives that accompany each benchmark are those same objectives that can be found on the ACRL's web site for the student Information Literacy Competency Standards for Higher Education.

After gathering research, the data from the interviews was compared to these standards to assess which faculty members are information literate and which are not. Each subject's interview was rated to determine how information literate those faculty interviewed were on a scale of one to five, one being "Optimal Level of Information Literacy" and five being "No Level of Information Literacy."

After the standards were set for assessing the optimal level of information literacy, the instruments were designed and developed. The in-depth interview questions were developed from a sample interview outlined in Chapter 3, Appendix B, of *The User-Friendly Handbook for Mixed Method Evaluation*. The closed-ended survey was developed from the format of a sample instructor evaluation used by the Division of Business and Social Sciences at South Georgia College.

The first instrument distributed was the closed-ended survey. Through campus mail, it was delivered to all fulltime, academic faculty members. The survey focused on more general and objective data that pertained to the information literacy perceptions of all faculty members from the various academic disciplines on campus. A memo from the Vice-President of Academic Affairs accompanied the survey, asking all faculty to participate in this research endeavor. A statement at the top of the survey explaining the purpose of the research ensured that the subjects knew the validity and confidentiality of the data retrieved. Each subject was asked to complete the survey and return it once they had answered all the questions. The data from all surveys were tallied using an Excel spreadsheet.

Six faculty members, roughly 15% of the faculty population, were randomly selected to interview. One interviewee was from each of the following academic areas: mathematics, sciences, Humanities, learning support,

business and social sciences. Before administering the interview, each participant completed a consent form so they fully understood the confidentiality of the interview. All interviews but one was tape-recorded. The interviews were not documented verbatim, but rather documented through the “note expansion” method of data collection. The tape recordings were only used for clarity and backup. The data from all interviews were compiled using a spreadsheet in Microsoft Excel.

The information found from the survey was compiled using the program Microsoft Excel. First, all responses from the survey were entered into an Excel spreadsheet. Each survey question was typed into the spreadsheet with each subject’s response listed in columns running along side the corresponding questions. The closed-ended questions on the survey easily allowed the options of “Strongly Agree,” “Agree,” “Disagree,” and “Strongly Disagree” to be translated into a scale of one to four, one representing “Strongly Agree” and four representing “Strongly Disagree.” After the surveys were conducted, a rating of five, which stood for, “Don’t Know,” was included since some participants wrote this answer in. The ratings for each question were averaged, establishing an overall rating for each question.

The data collected from the interviews were compiled and analyzed in much the same way as the survey. The interview questions were documented in a spreadsheet and all responses from those interviewed were typed into columns running side-by-side next to the corresponding question. This allowed for the answers given to a particular question to be seen at once for easy comparison to the standards. Each interview was rated on a scale of one to five, one representing “optimal level of information literacy” and five representing “no level of information literacy.” Finally, the overall rating for each interview was averaged to find the mean of all the interviews. This helped establish an information literacy rating for the entire faculty. This information was then compared with the results found from the survey data. Our hypothesis was that the general consensus of the survey would match the subjective observations of the interviews to provide an objective conclusion concerning the optimal and current levels of information literacy among the faculty of SGC.

## Results

Out of all surveys administered, 18 were returned. The responses of the surveys were tallied and the results placed in an Excel spreadsheet. Each subject’s response was tallied according to a rating; then each question received an average rating that allowed us to conclude our results.

Several intriguing results surfaced, as did a few problems in the design of the survey questions. On questions one (Information literacy is the ability to recognize when information is needed, then locate, evaluate and use that information effectively to fulfill the need. Given this definition of information literacy, at least 60% of SGC faculty are information literate.), two (Given the definition of information literacy stated above [in question one], you consider yourself to be information literate.), seven (All academic information obtained from the Internet does not need to be considered under copyright; it is available for all to use freely.), and nine (Faculty members who do not demonstrate information literacy in their course curriculum should attend workshops or activities to learn how to do so.), we received the expected outcome that we had hoped for. We had hypothesized that an average of the participants would have agreed that the majority of his or her colleagues, as well as him or herself, were information literate. We had also expected that an average of the participants would have disagreed on the issue of all academic information obtained from the Internet not being considered under copyright. Finally, we also anticipated that the average answer would be, “Agree,” when the participants were asked if faculty members who are not information literate need to attend workshops or activities to learn how to become information literate.

The other questions proved to have differing results from what we had expected. Question three asked participants if multimedia, electronic databases, and web sites were the primary media used by faculty to demonstrate information literacy in their course curriculum. The average answer was “Disagree.” We concluded that this finding suggests faculty members still prefer traditional printed resources to gain information, probably because most still use lesson plans that were developed before electronic resources were popular or available. This finding concurred with the results of our interviews as well. However, our results from question six (The first place you would look to find supplemental information on your academic subject would be to obtain printed materials, such as books, journals, and magazines, from the school library.) showed that “the tides are beginning to turn.” The average answer to this question was, “Disagree.” This means that the first place faculty would look for finding supplemental information is not traditional printed resources but rather non-traditional resources, e.g. electronic resources. As for whether they would recommend a web site to their students as the first place to find supplemental material for the course, question eight, the average response was barely “Agree” – 2.44. This proved that some teachers would have immediately recommended a web site and others would not have done so.

Questions four and five yielded a great deal of controversy since several people wrote in answers of, “Don’t Know,” or “Problematic question,” rather than answering. We believe that this confusion on question four - which asks if a faculty member uses on-site library and printed resources in his or her instruction, he or she is information literate - could have resulted from a design flaw in the survey. Participants may have thought from the previous three questions that information literacy only deals with technology. If question five - combining both printed and electronic media to yield the most information literate teacher - had come before question four, we believe more accurate results would have emerged for question four.

The greatest design flaw that we found from the survey was that several participants answered, “Don’t Know,” to questions one, three, four, and seven. These questions asked the participant to answer based on generalizations concerning the entire faculty. We felt that because Academic Freedom is highly upheld in post secondary education, those participants who answered, “Don’t Know,” did not want to guess at what their colleagues did in their classrooms because they truly do not know. The questions should have been reworded to ask the participants what they did in their own course instruction, not to generalize for the entire target population. This held true for all these questions except question seven. Subjects responded, “Don’t Know,” to this question because they truly do not know the laws and ethical standards associated with copyright on the Internet.

The most significant discovery from the survey results was that the average answer for question ten - whether or not those teachers who are not information literate would become more information literate if they had better access to technology - was, “Disagree.” This showed that most of those faculty members surveyed believe that even if specific technology were made available, a teacher would either continue to rely on traditional means of information gathering or that technology has no effect on how information literate one is.

The interviews were conducted within the span of one week. The following questions were asked of each participant - Question one: What types of resources do you use to gather information? Question two: How do you use technology to gather information? (If you do not use technology to gather information, why not?) Question three: Do you think a teacher’s use of technology in course instruction reflects knowledge of information literacy? Why or why not? Question four: What methods of information retrieval are best suited for your course instruction? Question five: What methods of information retrieval would you suggest to students for finding additional information for your course? Question six: What programs or activities do you think would help you become more information literate? Would technology be a part of those programs or activities?

The results from the In-depth Interviews supported some of the findings from the survey in greater detail. The average interview rating was 2.83, which ranked the average participant as being “Average Level of Information Literacy.” We found that to be a very positive result from the interviews. However, two interviewees ranked as being, “Above Average,” three ranked as, “Average,” and one ranked as being, “Below Average.” After having compared the participants’ answers to the Faculty Information Literacy Standards devised for this needs assessment, we ranked them according to the rating scale. The main areas that kept some interviewees from ranking higher were in Standard I where they did not show that they used a variety of types and formats of potential resources for information, particularly electronic resources. For example, the three subjects who ranked “Average” drew most of their resources from printed information, such as library databases, reference books, and textbooks. Very few electronic resources were used by these three subjects for gathering information. Two participants showed competencies in all areas of the standards while one person only showed competency in one standard - Standard IV. Subject #3 did not use a variety of resources (Standard I), did not retrieve information online or in person using a variety of methods (Standard II), and did not compare new knowledge to determine the value added, contradictions, or other unique characteristics of the information (Standard III). He relied mostly on his textbooks for all information gathering. This type of observation is also seen in the survey results on a more general scale.

Only four of the Standards were used when comparing the participants’ answers to the standards since none of the interview questions related to Standard V. This was a huge oversight on the part of the instrument designers. All other questions related to Standards I-IV, but no questions asked interviewees about their understanding of copyright or ethical use of information gathering. However, Subject #5 did volunteer that she would like to have programs or workshops to learn more about copyright laws as part of her answer to question six. This participant’s interview rating was “Above Average Level of Information Literacy.”

Several positive findings did emerge from the interviews, particularly in the answers to questions three and six. Most subjects answered question three with a clear understanding between being technology literate and information literate, even though technology literacy was not discussed by the interviewer. Question three asked whether or not a teacher’s use of technology in course instruction reflects his or her knowledge of information literacy. A majority of participants stated, “Not necessarily,” and went on to explain why. Subject #6 gave the best example, “For example, you may know how to use PowerPoint but not know how to find information on the subject for the presentation.” This was one of the greatest discoveries from the interview results. Question six yielded a

great deal of possible workshops or activities that could be implemented as part of the solution to this needs assessment.

### **Summary and Recommendations**

The purpose of this needs assessment was to investigate the current and optimal levels of information literacy among SGC faculty members. In other words, a gap existed between how faculty members currently gather information and how they should be gathering information. The data collected and analyzed for this assessment showed how faculty members are gathering information. The Faculty Information Literacy Standards, adopted from the ACRL's Information Literacy standards, shows the assessors how SGC faculty members should be gathering information. We believe that from the data collected, on average, the faculty members at SGC are performing at an acceptable level of information literacy. However, several steps could be taken to help the majority of faculty members become even more information literate.

One possible solution was addressed in the In-depth Interview. Interviewees were asked what programs or activities might help them become more information literate and would technology be a part of those programs or activities. Several subjects said that conferences and workshops involving particular types of technology would certainly help them. For example, one person would be interested in further Galileo training, two would like to learn more about how to retrieve information from the web and research using the Internet, yet another would like to explore how online chats can be used to hear and write Spanish.

One workshop that was highly recommended is one that was posed by Subject #5 from the Interview – programs or workshops to learn about copyright laws on the Internet. From both the survey and interview results, this is one area of the Information Literacy Standards that the SGC faculty members do not know nor understand. Knowing copyright and ethical laws concerning what to use and how much of it to use from the Internet and World Wide Web in course instruction is certainly a paramount issue vis -à-vis information literacy. These workshops do not have to be expensive or lengthy in time. As Subject #6 suggested in his interview, brown bag workshops held during lunch could be provided on campus by librarians or those faculty members considered highly information literate to help bring others up to task. To encourage participation, door prizes could be given out at the beginning of the sessions or a brown bag lunch be provided by the school for those who do come.

Another inexpensive solution to bridging the gap between the current and optimal states of information literacy among faculty would be to hold periodical teaching circles in which a group of teachers from various disciplines come together once a month to discuss how they gather information and use it in their course instruction. This could also be done during a lunch hour in which the teachers go out to a favorite restaurant or bring a brown bag lunch. Not only would teaching circles promote information literacy, but it would also promote camaraderie among the faculty members. This would, in turn, provide a solid networking foundation for faculty members to pull upon each other as resources. It would also help expose all faculty members to a variety of up-to-date information search methods. This would be the most feasible solution to implement.

A third solution that would help teachers become more information literate at SGC would be for the administration to make the scholarship of teaching an even higher priority than what it is now. This could be relatively inexpensive for the school depending on the help from administrators and division chairpersons. The scholarship of teaching would deal with faculty members making a conscious effort to improve their course delivery methods and up-date their information literacy to make teaching a valid area of research. Through course instruction improvements, faculty members can begin to vie for specific grants and fellowships that reward those who excel in the scholarship of teaching. However, this will require that the administration support a faculty member's endeavors and provide him or her with the necessary means of improving course delivery. This could include buying or providing up-dated technology or paying for particular off-campus workshops or grant writing conferences.

In conclusion, a more in-depth needs assessment should be conducted in the area of information literacy at SGC. The needs assessment conducted here was extremely small in scale and uses instruments flawed in design. Although the majority of results obtained are valid, further investigation in this area would bring about more accurate results. Therefore, more information does need to be gathered, not only from the perspective of the faculty, but also from the perspectives of the administration and the students. If objective and thorough research is to be found, more subjects need to be interviewed and surveyed, and a wider variety of instruments need to be used for finding data.

### **References**

Association of College and Research Libraries. (2000, January 18). *Association of College and Research Libraries Information Literacy Competency Standards for Higher Education*. [Online]. Retrieved October 17, 2000, from the World Wide Web: <http://www.ala.org/acrl/ilstandardlo.html>.

Campus Computing Survey: Adding Technology to Teaching a Top Issue. (2000, October). Edupage [Online serial]. Available E-mail: EDUCAUSE<[EDUCASUE@EDUCAUSE.EDU](mailto:EDUCASUE@EDUCAUSE.EDU)>

Roth, Lorie. (1999). Educating the Cut-And-Paste Generation. *Library Journal*, 124, 18. Retrieved October 5, 2000 from EBSCOhost on GALILEO from the World Wide Web: <http://www.galileo.peachnet.edu>

Stevens, F., Lawrenz, F., & Sharp, L. (1997). User-Friendly Handbook for Project Evaluation: Science, Mathematics, Engineering, and Technology Education. Arlington, VA: National Science Foundation.

User-Friendly Handbook for Mixed Method Evaluations. (1995). Arlington, VA: National Science Foundation.

# What Types of Online Facilitation Do Students Need?

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## Abstract

*The purpose of this study is to investigate facilitation in an online learning environment. The types of facilitation are examined using distance course students as subjects. Students' characteristics such as prior experience in distance courses, demographic attributes such as age, gender, and grades are incorporated as variables to explore their relationships with facilitation. This study first identifies major types of online facilitation that students requested in a web-based course. Then this study inspects whether students with different characteristics requested different types of online facilitation. Finally this study examines whether the amount of message requesting online facilitation is associated with learning achievement. The participants of this study were 29 college students in a web-based course at a state university. The course requires students to actively participate in online activities and all course assignments are submitted as electronic files via the course site. Research data are the threaded messages that were posted by students, the instructor, and the TA in the designated areas in the course site. Threaded messages posted through entire semester are collected. Five types of online facilitation were identified in this study. Findings and implications of findings regarding the relationships among types of online facilitation, student characteristics, and learning achievement were discussed. It was found that students requested more facilitation in assignments and grade criteria, and in network access. Different student characteristics were found to prefer different types of facilitation. Implication of this study for web-based course design and teaching was then suggested.*

## Introduction

As more college courses are placed online, effective instruction tools of online courses has become one of key issues of investigation. Among the instruction tools adopted in online courses, facilitation is a variable less studied. The purpose of this study is to explore facilitation as an effective instruction tool and examine the relationships among types of online facilitation, student characteristics, and learning achievement. Students taking online courses tend to learn alone in front of their computers and are distant from their instructors or classmates both physically and psychologically. Therefore, they need assistance in solving problems such as accessing to course materials in course site or in clarifying expectations of assignments online. The instructor or student peers may respond to a student's request so the student can learn to get what he needs online. Therefore, facilitation is even a more important factor in scaffolding learning in web-based environments as compared to the traditional classrooms. However, very few existing studies have looked into the nature of facilitation in online learning environments. This has presented a research opportunity for this study to explore types of facilitation and variables affecting facilitation.



Figure 1. Relationships examined in this study

The findings of the study will provide new insight into designing and teaching web-based courses. Specifically, the study identifies types of online facilitation and suggests that both web-based course designers and instructors should pay more attention to some particular types of facilitation that students requested more often. The findings also suggest that different students may require different amount of facilitation.

## Literature Review

### Online Facilitation

In online learning environments, on-line facilitation has been proposed in previous studies as an effective pedagogical strategy to increase interaction and, then, to enhance learning achievement. Althaus (1997) studied the effects of computer-mediated discussion (CMD) on learning achievement. He recommended providing facilitation in order to encourage students to participate in CMD, especially those students who lacked online skills. Hmelo, Guzdial, and Turns (1998) investigated the effect of an online forum for collaboration and reflection in the Collaborative and Multimedia Interactive Learning Environment (CaMILE). The authors suggested that some forms of online facilitation were needed either to provide a logical connection between student activities and conceptual topics or to provide the concrete referent that was needed for reflective discussion. Furthermore, Garland (1993) inspected students' perceptions of barriers in completing distance courses. To overcome these barriers, she recommended providing adequate facilitation to students in terms of more communication. Although online facilitation has been suggested as an effective pedagogical strategy by many researchers, it is unclear that whether online facilitation is equally effective in different student demography.

### **Student Characteristics**

Student characteristics have been predicted to have impact on learning outcomes. Major student characteristics investigated in computer-aided or online learning environments are prior experience in similar learning environments, personal attributes, and learning achievement. As to prior experience, previous studies suggest that prior experiences in using computer are positively related to academic achievement. Althaus (1997) found that students who had more e-mail experience were more willing to participate in Computer-Mediated Discussion (CMD), and students who fully participated in CMD performed better than others who participated less. Grantham and Vaske (1985) found that the amount of prior experience in e-mail was positively associated with telecomputing use. Hiltz (1993) concluded that students' comfortableness with computers was one of the major characteristics that would lead to better learning in computer-aided environments. Also, Harris and Grandgenett (1996) found that telecomputing experience was positively related to greater online time, and greater online time could lead to higher achievement.

The consistent positive association between prior experience in using computer and more efforts on online learning may imply that students who have no experience in distance learning may need more facilitation to assist them. But, there are few studies examining the relationship between the need for facilitation and prior experience.

Regarding student's personal attributes such as gender and age, there is little research that studies how personal attributes affect the need for facilitation. Previous studies, investigating learner characteristics and computer anxiety in computer-aided learning environments, suggest that such a link may exist. High computer anxiety students may need more facilitation to reduce anxiety level. However, previous studies on computer anxiety showed inconclusive results concerning the relationship between personal attributes and computer anxiety.

A meta-analysis of 81 studies reported that computer anxiety was not significantly correlated with gender and age (Rosen & Maguire, 1990). But, another study reported that feminine-identity students showed higher anxiety than masculine-identity students did (Rosen & Sears, 1987). Other studies also reported significant correlation between computer anxiety and age. In one study it was reported that older adults (55 years old and over) appeared to have less computer anxiety than younger adults (30 years old and under) did (Dyck & Smither, 1994). However, in other studies it was reported that older students were more computer anxious than younger students (Rosen, Sears, & Weil, 1987; Jones & Wall, 1989). Five studies of over 450 college students compared the computer anxiety of computer and business major students with that of other major students and found that computer anxiety consistently correlated with students' majors (Rosen, Sears, & Weil, 1987).

### **Learning Achievement**

While previous studies addressed very little about the relationship between online facilitation and learning achievement, some studies examining the relationship between computer anxiety and learning achievement. A study explored components of computer anxiety and found there was no significant relationship between anxiety and students' academic achievement in the computer course as measured by their course grades (Jones & Wall, 1989). Although computer anxiety may be viewed as an indicator to the need for online facilitation, it is hard to draw any conclusion without more studies. Thus, this study is devoted to investigating the relationship between learning achievement and online facilitation.

### **Method**

## Participants

The participants of this study were 29 college students, 21 females and 8 males, who enrolled in a web-based course at a state university. 14 participants majored in Open Distance Learning and 15 participants in other degree programs. Participants' ages are 19 and above. All 29 participants were voluntarily participated in this study.

## The Course

This study was conducted in a course that was entirely delivered via a web-based course site. The course title was Learning Theories and Cognition in Instruction and was offered by the College of Education at a state university in the southeast of the United States. Students were required to submit all assignments electronically via the course site. Also online participation in activities was mandatory. The final course grade consisted of four assignments (60%) and online participation (40%).

Three designated areas in the course site were created for students to post requests for facilitation. These areas were Online Office, Student Lounge, and Information Sharing (Figure 2). Students were encouraged to post messages in these areas for asking extra assistance, raising questions, expressing concerns, and sharing information with the class. The instructor, the teaching assistant (TA), and students might respond to messages in these areas. Also, the instructor and the TA might also respond in the Announcements area in the course site (Figure 3).



Figure 2. Online Facilitation Areas

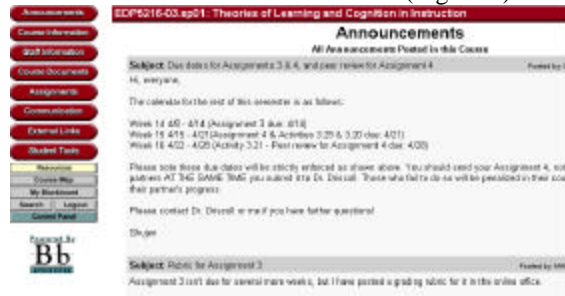


Figure 3. Announcements

## Data collection and Analysis

Research data were the threaded messages that posted by students, the instructor, and the TA in the Online Office, Student Lounge, Information Sharing, and Announcements areas in the course site. These data were collected through an entire semester. In the beginning of the semester, a survey, which collected the information of students' demography, personal particulars, and prior experience in distance courses, was filled by participants.

First, based on the senders of messages, messages were classified into two categories: requesting for facilitation and responding to requests. Then, based on the content of questions or responses in the message texts, these messages were further classified into different facilitation types within each category. Total frequencies of requesting facilitation and responding to requests were tallied. Finally, cross tables of facilitation type, student characteristics, and learning achievement were generated.

## Results

### Types of Online Facilitation

Five types of online facilitation were identified from the content analysis of the threaded messages as posted by students in the course site. The total number of request messages, which requested for facilitation, was 33. These five facilitation types with descriptions are listed in the following:

1. Assignments and grades: Messages that asked questions about due dates, the instructor's expectation, grading criteria of assignments, and course grades
2. Network access: Messages that asked questions about the access to WWW network and online course materials in the course site
3. Online discussion: Messages that asked questions about clarification, reflections, and suggestions of online discussion
4. Group activities: Messages that asked questions about group activities



5. Other course materials access: Messages that asked questions about the access to the textbook, study guide, the university, and local libraries

The results indicated that the most requested type of facilitation was Assignments and grades, which included 13 messages and represented 39% of total messages that asked for facilitation. The second most requested type of facilitation was Network access, which included 11 messages representing 23% of total messages that asked for facilitation. See Table 1 for the frequency of messages that requested online facilitation in each facilitation type.

There were 85 response messages that responded to the request messages. Based on the persons who responded, the messages were sorted into three categories: instructor, TA, and peer. Peer responses were the highest responses in all five facilitation types. Peers responded 54 messages, which consisted of 64% of total responded messages. The instructor and TA responded 16 and 15 messages and consisted of 19% and 18% of total response messages, respectively. See Table 1 for the frequencies of response messages from the instructor, TA, and peer in each facilitation type.

### Student Characteristics and Online Facilitation

**Experience in distance courses.** There were 33 request messages posted by 24 experienced students and 0 messages posted by 5 non-experienced students. The average number of messages was 1.38 per experienced student and 0.00 per non-experienced student.

Table 1. Types of facilitation that students need in a web-based course

Facilitation Type	Frequency**	Responded by***			Total Responses
		Instructor	TA	Peer	
Assignments & grades *	13* (39%)	10 (25%)	8 (20%)	22 (55%)	40
Network access*	11* (33%)	0 (0%)	2 (7%)	26 (93%)	28
Online discussion	5 (15%)	5 (50%)	2 (20%)	3 (30%)	10
Group activities	3 (9%)	1 (17%)	3 (40%)	2 (33%)	6
Other course materials access	1 (3%)	0 (0%)	0 (0%)	1 (100%)	1
Total	33	16 (19%)	15 (18%)	54 (64%)	85

\*The most needed two types of facilitation \*\*Percentage of total frequency\*\*\*Percentage of total responses

**Gender.** Among the 33 messages requesting for facilitation, 27 messages were posted by 21 females and 6 messages were posted by 8 males. The average number of messages was 1.29 per female and 0.75 per male.

**Age.** There were 13 messages posted by 17 younger students (age 19 – 35 years) and 20 messages posted by 12 older students (age 36 and above). The average number of messages was 0.76 per younger student and 1.66 per older student.

**Major.** There were 29 messages posted by 14 students of Open Distance Learning major and 4 messages posted by students of other majors. The average number of messages was 2.07 per student of Open Distance Learning major and 0.27 per student of other majors.

**GPA.** In order to have similar number of students in each cluster, GPA was classified into three clusters: low GPA (3.0-3.69), medium GPA (3.70-3.99), High GPA (4.00). There were 16 messages posted by 11 high GPA (4.00) students, 17 messages posted by 9 medium GPA (3.70-3.99) students, and 0 messages posted by 8 low GPA (3.00-3.69) students. The average number of messages was 1.45 per high GPA student, 1.89 per medium GPA student, and 0.00 messages per low GPA student. Table 2 lists the amount and average of messages that requested facilitation under each student's characteristic.

Table 2. Student Characteristics and Online Facilitation

Student Characteristic		Total number of students	Total frequency of requesting facilitation	Average Frequency per student
Experience in distance courses	No	5	0	0.00
	Yes	24	33	1.38
Gender	Female	21	27	1.29
	Male	8	6	0.75
Age	Younger (age 19-35)	17	13	0.76
	Older (age 36 and above)	12	20	1.70

Major	Open Distance Learning	14	29	2.07
	Other majors	15	4	0.27
GPA*	Low (3.0-3.69)	8	0	0.00
	Medium (3.70-3.99)	9	17	1.89
	High (4.00)	11	16	1.45

\*There is one datum missing in GPA.

### The Most Needed Facilitation Type within Each Student Characteristic

The most requested facilitation type within each student characteristic was analyzed. Overall, the results showed consistently that the most requested types of facilitation were: 1) Network access, 2) Assignments and grades. However, further observation reveals that the most requested facilitation may differ in different student characteristics. It can be observed that students with prior distance learning experience needed facilitation in assignments and grades the most, while non-experienced students desired facilitation in network access the most. The most needed facilitation for female students was assignments and grades, whereas for male students was network access. While younger students (years 19 – 35) needed facilitation in assignments and grades the most, older students (years 36 and above) requested facilitation in network access the most. Open Distance Learning majors needed facilitation in network access the most, and other major students desired facilitation in assignments and grades the most. Both high and medium GPA students needed facilitation in network access the most. However, low GPA students did not request any facilitation. See Table 3 for the most needed type of facilitation in each learner characteristic.

Table 3. The Most Needed Facilitation Type by Student Characteristic

Student Characteristic		Facilitation Type
Experience in distance learning	No	Assignments & grades
	Yes	Network access
Gender	Female	Assignments & grades
	Male	Network access
Age	19-35	Assignments & grades
	36 and above	Network access
Major	ODL	Network access
	Other majors	Assignments & grades
GPA	Low (3.00-3.69)	None
	Medium (3.70-3.99)	Network access
	High (4.00)	Network access

### Learning Achievement and Online

The final course grade was categorized into three clusters: low grade (2.19-3.46), medium grade (3.47-3.82), and high grade (3.83-4.00) with each cluster having similar number of students.. The total number and the average of the messages that requested facilitation in each cluster of the final course grade are listed in Table 4. Table 4 shows that low-grade and high-grade students posted an average of 1 message per person while medium grade students posted an average of 1.4 messages per person.

Table 4. Learning Achievement and the Amount of Online Facilitation

Final Course Grade	Low (2.19-3.46)	Medium (3.47-3.82)	High (3.83-4.00)
Total number of students	10	10	9
Frequency of requesting facilitation	10	14	9
Average Frequency per student	1.00	1.40	1.00

The average of request online facilitation, then, was calculated under each student characteristic within each cluster of the final course grade. The results showed 0 message posted by non-experienced students in all grade clusters. The result also showed similar averages of messages posted by experienced students in all grade clusters, 1.25, 1.56 and 1.29 messages per experienced student for low, medium, and high-grade students, respectively. For female students, medium-grade students posted the most (1.43) messages per student; and for male students, the

high-grade students posted the most (1.50) messages per student. For younger students, high-grade students posted the most (1.50) messages per student; and for older students, medium-grade students posted the most (2.00) messages per student. For Open Distance Learning students, medium-grade students posted the most (3.25) messages per student; and for other major students; low-grade students posted the most (1.67) messages per student. The results showed 0 message posted by low GPA students in all grade clusters. For medium GPA students, low-grade students posted the most (3.33) messages; and for high GPA students, medium-grade students posted the most (2.00) messages.

Overall, The result showed that among experienced, female, older, Open Distance Learning major, and high GPA students, medium-grade students requested more facilitation than either low or high-grade students. The result also showed that among other majors and medium GPA students, low-grade students requested more facilitation than either medium or high-grade students. In addition, the result showed that among male and younger students, high-grade students requested more facilitation than either low or medium-grade students. Table 5 lists the average of request online facilitation by student characteristics within final course grade clusters.

*Table 5. The Average of Request Online Facilitation by Student Characteristics within Grade Clusters*

Request Facilitation		Final Course Grade		
		Low (2.19-3.46)	Medium (3.47-3.82)	High (3.83-4.00)
DL Experience	No	0	0	0
	Yes	1.25	1.56	1.29
Gender	Female	1.14	1.43	.086
	Male	0.67	1.33	1.50
Age	Younger (19-35)	1.14	1	1.50
	Older (36 and above)	0.67	2.00	0.60
Major	Open Distance Learning	0	3.25	1
	Other majors	1.67	0.17	1.00
GPA	Low (3.0-3.69)	0	0	0
	Medium (3.70-3.99)	3.33	1.33	1
	High (4.00)	0.00	2.00	1.20

\*DL experience: experience in distance learning

## Discussion

### Types of Online Facilitation

Five types of online facilitation were identified. They were, in the order of descending frequency of request: 1) Assignments and grades 2) Network access 3) Online discussion 4) Group activities 5) Other course materials access. This result suggests that from students' viewpoints the most desired facilitation is assisting them to complete the assignments and to obtain high grades. The second most needed facilitation is the assistance in network access to course materials and participating in the activities in the course site.

This finding of assignments and grades as the most needed type of facilitation shows strong implications in web-based course design and teaching. For web-based course design, instructional system designers should make the description of assignments and grading criteria particularly clear so that it can thoroughly communicate with students about the expectations of the course. For web-based course teaching, although the descriptions of assignments and grading criteria may be clearly stated in the course site, students may overlook them. Instructors should instruct students to the location of specific pages or even demonstrate to students how to access to this particular information containing assignments and grading criteria in the course site.

The implication of this finding concerning network access as the second most requested type of facilitation is that both web-based course designers and instructors should take students' computer literacy into consideration while designing and teaching web-based courses. Although telecommunication technology is very promising most of the time, it seems also very discouraging sometimes. Network disconnection occurs irregularly if not frequently in everyday practice. There are so many factors that may affect the network connection and, consequently, may cause communication barriers between students and instructors. Some of these problems may not be controllable or fixable by students. Flexibility of schedule should be built within web-based course design. Due dates of

assignments and activities should not be too rigid in order to allow time for solving unexpected telecommunication problems. Instructors should seek prompt support from the system support team, who is responsible for the course delivery system, so that any telecommunication problems can be solved as soon as possible.

### **Response Messages**

About two thirds (64%) of the total response messages was posted by students, while the instructor together with the TA provided about one third (37%). This finding implied that peers contribute a great deal of facilitation. The willingness of providing help among peers in this web-based learning environment appears to be strong. This result suggests that interaction among students plays an important role in distance learning environments. Peer interaction should be included as an essential instructional strategy in web-based course design. Web-based course instructors should build rich learning communities in course sites and encourage students to actively provide facilitation to peers.

### **Student Characteristics and Online Facilitation**

The most important finding from this study was that all 33 messages that request for online facilitation were posted by experienced distance students. In contrast, no message was posted by non-experienced distance students. The reason why this result produces such a strong contrast may be because experienced students know how to request online facilitation whereas non-experienced students may not know. Although it is speculated that non-experienced students may need and request more facilitation than experienced students do, the data seem not able to support such a speculation. The data can only be explained by the fact that non-experienced students have problem learning to use online communication tools to express their needs for online facilitation. The online tools of communicating via the course site are new to non-experienced students and they may be less comfortable in using these new tools.

Although this finding indirectly supports previous findings that experienced students spend more time online than non-experienced students do (Vaske, 1985; Hiltz, 1993; Grandgenett, 1996; Althaus, 1997), the hypothesis that non-experienced students will request more online facilitation was not supported in this study. How to reveal the need for online facilitation from non-experienced student will be an important research challenge in the future.

The average frequency of requesting facilitation is higher in females (1.29 per female) than in males (0.75 per male). If requesting for facilitation is an indication of anxiety, this finding indirectly supports previous studies that feminine-identity students were found to appear more computer anxious than masculine-identity students do (Rosen & Sears, 1987). Given that existing studies involving gender effects in computer-related learning have produced inconsistent findings, this finding of significant gender effects should be considered as tentative. Further research in examining the relationship between learner's gender and the need for online facilitation is still needed.

The average number of messages posted by older students (1.70 per student) to request for online facilitation was higher than those posted by younger students (0.76 per student). This finding supports some studies that older students are found to be more computer anxious than younger students (Rosen, Sears, & Weil, 1987; Jones & Wall, 1989).

The average number of messages posted by Open Distance Learning major students (2.07 per student) was higher than other major students (0.27 per student). This finding indirectly supports a previous result that computer anxiety consistently correlated with students' majors (Rosen, Sears, & Weil, 1987). Once again that further research is desired for directly addressing the relationship between student's major and the need of online facilitation.

The average number of messages that requesting online facilitation posted by high and medium GPA students (1.45 per high GPA student, 1.89 per medium GPA student) were higher than low GPA students (0.00 per low GPA students). Low GPA students did not even request any online facilitation at all. They seem either not know how to request facilitation or have low learner motivation to solve problems that are pointed out in the online messages. This finding may suggest that the learner motivational factors should be built in both web-based course design and teaching. If the web-based course design can gain and sustain students' attention to the focus of the course contents, enhance relevance between course contents and the learners' concerns, build students' confidence about themselves, and generate students' satisfaction about the course, students may be more motivated to solve problems and to request necessary facilitation.

### **The Most Needed Facilitation Type within Each Student Characteristic**

The finding indicated, for each student characteristic, the most desired facilitation type was either network access or information of assignments and grades. Further data analysis reveals that, on one hand, female, younger, other majors, non-experienced, and medium and high GPA students requested facilitation in assignments and grades the most. On the other hand, male, older, Open Distance Major, and distance learning experienced students needed facilitation in network access the most. Female, younger, other majors, non-experienced, and medium and high GPA students may be less sure about their learning achievement, so they are more concerned about assignments and grades. On the contrary, male, older, Open Distance Major, and distance learning experienced students have more confidence on their online skills but may need more help in fully utilizing online resources. Such a difference in facilitation preference between student characteristics deserves further study to provide more explanation.

With respect to grades, this study found that low GPA students did not even request any facilitation. The possible explanation is that low GPA students may not have enough motivation to learn.

Overall, the implication of the above findings is that, from students' viewpoints, assignments, grades, and network access should be the central foci of web-based courses. Expectations of assignments, grading criteria, and the guidelines of course site access should be well stated in course sites and thoroughly communicated with students by the instructor.

### **Learning Achievement and Online Facilitation**

The result showed that among experienced, female, older, Open Distance Learning major, and high GPA students, medium-grade students requested more facilitation than either low or high-grade students. It implies that if low-grade students had requested sufficient facilitation, they may achieve better grades. High-grade students may already have the ability to learn by themselves without much facilitation.

The result also showed that among other majors and medium GPA students, low-grade students requested more facilitation than either medium or high-grade students. This finding indicates that other majors and medium GPA students have experienced learning difficulties in the course. It not only suggests that web-based instructors should provide more facilitation to other majors and medium GPA students, but also propose a further research question – what kind of difficulties that other majors and medium GPA student may have experienced and how to assist them for better learning experiences.

In addition, the result showed that among male and younger students, high-grade students requested more facilitation than either low or medium-grade students. High-grade students may have stronger motivation to solve problems and concern more about learning achievement so they asked for more facilitation than low or medium-grade students do.

### **Conclusion**

This study identifies five types of online facilitation requested by students. Among them, the two most requested types of online facilitation are 1) assignments and grades 2) network access. This study also makes suggestions for web-based course design and teaching. The following summarizes these suggestions:

1. Make due dates of assignments and activities flexible and explicitly clear
2. Thoroughly communicate with students about the expectations of assignments and grading criteria
3. Seek immediate supports from system support team to solve problems in the event that network access problems occur
4. Design instructional strategies emphasizing peer interaction in web-based courses and encourage peer interactions in teaching web-based courses
5. Employ learner motivational strategies in order to encourage low GPA students and non-experienced students to request facilitation online

The major limitation of this study is the small size of the research sample. There are 29 students participated in this study. With such a small number of participants and 3 to 5 categories in each variable to be analyzed, it is very difficult to employ statistical tests that will show meaningful results. Therefore, the findings from this study should be considered as tentative, and generalization from the conclusions of this study should be very limited.

A repetition of this study with larger sample size is recommended. With a large number of participants, sufficient data can be collected for statistical analysis in order to generalize meaningful conclusions.

More variables should also be incorporated to develop the concept of facilitation and better understand the nature of facilitation. It is still unclear that lack of online skills needs more facilitation or is just not able to post

request for facilitation. It is also uncertain about the relationship between computer anxiety and request for facilitation.

Overall, this study identifies five types of online facilitation that students requested. Further research may be conducted to further verify these five types of online facilitation and to explore their relationships with learner characteristics and learning achievement.

## References

- Althaus, S. L. (1997). Computer-mediated communication in the university classroom: An experiment with online discussions. Communication Education, 46, 158-174.
- Dyck, J. L. & Smither, J. A (1994). Age differences in computer anxiety: The role of computer experience, gender, and education. Journal of Educational Computing Research, 10(3) 239–248.
- Garland, M. R. (1993). Student perceptions of the situational, institutional, dispositional and epistemological barriers to persistence. Distance Education, 14(2), 181-198).
- Hmelo, C. E, Guzdial, M., & Turns, J. (1998). Computer-support for collaborative learning: Learning to support student engagement. Journal of Interactive Learning Research, 9(2), 107-129.
- Jones, P. E. & Wall, R. E. (1989). Components of computer Anxiety, 18(2), 161-168.
- Kay, R. (1992) An analysis of methods used to examine gender differences in computer-related behavior. Journal of Educational Computing Research, 8(3), 277-290.
- Lee, D. M. S., Pliskin, N., & Kahn, B. (1994). The relationship between performance in a computer literacy course and students' prior achievement and knowledge. Journal of Educational Computing Research, 10(1) 63-77.
- Rosen, L. D., Sears, D. C., & Weil, M. M. (1987). Computerphobia. Behavior Research Methods, Instruments, & Computers, 19(2), 167-179.

# Listen to Me: Four Web-Based CSCL Students' Perspectives and Experiences in Group Collaboration and Knowledge Construction in Cyber Space

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## Abstract

*The main purpose of this Naturalistic inquiry study is to explore four ethnically diverse Web-based Computer Supported Collaborative Learning (CSCL) students' perceptions of and experiences in knowledge construction and group collaboration. Findings suggest that individual and group successes are interconnected and rely on successful negotiation and construction of shared knowledge among group members. While effective collaboration and knowledge construction among people of diverse backgrounds may be challenging, Web-based collaborative learning among similar populations may pose additional challenges than in face-to-face settings due to the absence or limited non-verbal communication cues. Educators interested in designing online courses for students of diverse backgrounds should not only consider the cognitive but also the social and cultural aspects of communication. Future studies should focus on exploring effective course design to facilitate both cognitive and social aspects of learning and to optimize individual as well as group learning.*

## Introduction

Assisted by technological advances, Web-based instruction is widely employed in preparing learners for “future responsibilities” and “success in life” (Dewey, 1938). To meet individual learner’s needs while optimizing their strengths and talents, Confucius said, instruction should be tailored to meet individual learner’s needs.

A plethora of distance-learning research studies have been conducted and Computer Supported Collaborative Learning (CSCL) has been one of the major focuses. However, most CSCL studies have addressed issues regarding tools, design, course impact, and evaluations from instructors’, administrators’, or instructional designers’ observations. Few of these studies, however, have addressed these issues through the lenses of students. I became aware of the importance of studying human interaction (as opposed to focusing solely on technical functionality) from participating in the design of the CSCL course.

Conducted within the constructivist paradigm, this research focused on four ethnically diverse students’ perceptions of and experiences in a computer-supported collaborative learning class where a major aspect of the course design was based on constructivist theory. The purpose of the study is to explore students’ perspectives on group collaboration and knowledge construction in a CSCL class offered in Fall 2000 at University of Texas.

Naturalistic inquiry was employed as the research strategy for this study. Egon Guba referred to this inquiry method as the “constructivist inquiry. As described by Erlandson et al.(1993), naturalistic paradigm assumes that there are “multiple realities;” affirms the “mutual influence that researcher and respondents have on each other;” and assumes that “total generalization is never possible.”

In order to avoid framing interviewees, this study was guided solely by one focus question, “How did you perceive the group collaboration and knowledge construction work in your CSCL 2000 class?” Group collaboration and knowledge construction were focused upon because they were the two essential course objectives.

## Study Context

CSCL is derived from CSCW (Computer Supported Collaborative Work), which was named after “Office Automation” (a system that aimed at facilitating businesses for efficient and effective work). The main differences between CSCL and CSCW are their contexts and purposes. CSCW focuses on getting work done and is mainly employed in business settings where sectors, departments, and companies collaborate to complete projects and make decisions. CSCL focuses on learning and is employed in educational settings where collaborators in the learning community construct knowledge and accomplish joint projects. Resta, et al. (1999) said CSCL maybe used as the “catalyst for changing teacher practice” as teachers are “continually revising their curriculum design” based on their experiences and “emergent instructional needs” (p. 492). Such curriculum, rather than relying on a set plan to achieve predetermined outcomes, provides a platform for discourse and interaction between and among students, peers, and course-content experts. The CSCL curriculum enables knowledge construction and problem-solving

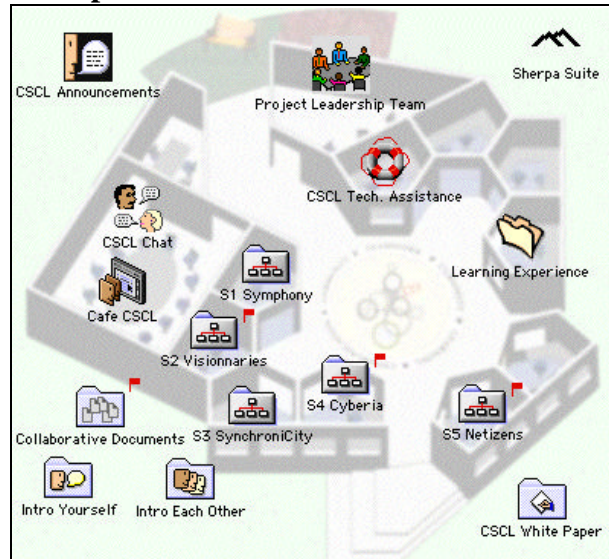
among collaborators of diverse backgrounds. The instructors' role is transformed from that of a "sage on the stage," to that of a "guide on the side."

A major goal of this CSCL 2000 course was to assist learners to understand, create, and reflect through the engagement in projects similar to real-life. A variety of instructional material, resource links, and task instructions were available on the Web via WebCT courseware. The course content was divided into seven modules, a course handbook, a course tool page, and a resource link page (Graph #1). Each module contained tasks requiring learners to work both individually and collaboratively in completing tasks. Collaborative tasks included writing a topic paper, designing a tour in a MOO (Multi-user Object Oriented) virtual environment where users log onto a site to experience a text-based virtual reality environment, designing a WebQuest and working collaboratively with cross-team members to develop a final project utilizing a schedule planning tool for coordination (jointplanning.com). A WebQuest is an inquiry activity that is based on realistic and engaging tasks and the resources drawn by learners are from the Web. Its focus is on "using information rather than looking for it, and to support learners' thinking at the levels of analysis, synthesis and evaluation" (Dodge, Bernie).

**Graph # 1: Course Web Site**



**Graph # 2: Course Discussion Virtual Works**



Module One provided an overview of the course goals, objectives, required entry skills, technology requirements, course activity schedule, and other information helpful to the students in preparing to complete the course. Module Two provided opportunities for online socialization through introduction of the course mission, the online environment, and technological tools, while encouraging students to socialize with peers through a class-wide introduction activity. Modules Three, Four, and Five enabled students to exchange information and construct knowledge through online communication, search and exchange information, perform assigned tasks, and provided mutual support and cooperation among online team members. Students worked collaboratively to navigate and explore various network environments, utilizing collaborative tools to plan group projects, schedule meetings, negotiate tasks, develop ideas and concepts, make decisions, and edit finished projects as a group. Participants engaged in building a collaborative team, utilizing collaborative writing strategies, exploring synchronous online collaborative learning, and inquiring skills to develop a WebQuest, a Web-based activity that involves searching, reading, analyzing, and dialoging with peers to solve problems and create Web pages. The course handbook offered a virtual office tour, an organization chart about this virtual company, a directory of both students and staff, tips on working collaboratively, topics for collaborative work, and project examples.

To accomplish course requirements, online socialization and communication were essential. Extensive cooperation and collaboration among learners was necessary. A course discussion virtual workspace (Graph #2) offered students the opportunity to exchange information, discuss tasks, upload files, work collaboratively, and socialize both asynchronously and synchronously. CSCL Technology Company was employed as a metaphor to indicate a real world professional setting. Members of the class were divided into five virtual teams located in suites. There are two to three offices within each suite. Two to three students shared the same office and about six to seven students shared the same suite. Diversity (ethnic background, gender, and on-campus or tele-campus access) was considered when assigning students their suites at the beginning of the semester.



There were five Webcasts (video-conferences) throughout the semester. On-campus students had the opportunity to attend on campus while tele-campus students attended through the Web. Additional modes of participation included telephone call-in and synchronous chat.

The product of the course was the accumulated contributions from learners through an emphasis on collaborative learning. Learners engaged in a variety of projects in order to understand the CSCL environment, create projects utilizing tools for collaborative learning, and reflect their own learning through personal journaling. Hence, course success resided completely on the students' success in collaboration.

## **Method**

### **Naturalistic Inquiry**

Naturalistic inquiry was employed as the research strategy for this study. Egon Guba (1981) referred this as the "constructivist inquiry." Guba pointed out that the "naturalistic inquiry is not equivalent to qualitative inquiry." Naturalistic inquiry utilizes "human instrument" – the researcher, with findings "created" through the interaction between the researcher(s) and participants (Erlandson, et.al., 1993 p. ix-xv). The naturalistic paradigm:

1. **Assumes that there are "multiple realities"** – While the Positivist view holds that there is a single objective reality, the naturalistic view assumes that "all the 'parts' of reality are interrelated.
2. **Affirms the "mutual influence that researcher and respondents have on each other"** – Naturalistic theorists asserts that "mutual simultaneous shaping" (the interaction between researchers and respondents) is unavoidable and the researcher must find ways to "control the biases that do not inhibit the flow of pertinent information (p. 15).
3. **Assumes that "total generalization is never possible"** – Unlike most scientific studies which seek to generalize findings, naturalistic inquiry seeks to include "thick description of one set of interrelationships in one social context" to allow "transfer of understanding" for readers across social contexts (Guba, 1981).

Guba, (1981) said that quantitative and qualitative methods can both be used in a naturalistic paradigm but qualitative research method is "generally preferred." He said that while "relevance" and "rigor" are both important, "relevance" is more important in the naturalistic paradigm. In the naturalistic paradigm, "emergent theory" is preferred," according to Guba. While all researchers use a variety of instruments to obtain data, in the naturalistic research, the "primary research instrument is the researcher" and is conducted in a "natural setting" rather than a "laboratory or controlled setting."

### **Constructivism**

The philosophy behind the design of the CSCL course is Constructivism. The philosophy behind the design of the current naturalistic study is also Constructivism. Fosnot (1996) said Constructivism is a theory about knowledge and learning that explores both "what knowing is and how one comes to know." This theory, he said, describes knowledge as "temporary, developmental, nonobjective, internally constructed, and socially and culturally mediated." Constructivists view learning as a self-regulatory process in which learners constantly make meanings to construct and gain new knowledge and insights.

Jonassen (1994) identified the following elements of constructivist design: (1) multiple representations of reality, (2) representing the complexity of the real world, (3) emphasizing on knowledge construction instead of knowledge reproduction, (4) emphasizing authentic tasks in a meaningful context rather than abstract instruction out of context, (5) preferring real world settings to predetermined sequences of instruction, (6) encouraging thoughtful reflection on experience, (7) knowledge construction based on both content and context, (8) knowledge construction arrived at collaboratively rather than competitively.

As Duffy and Jonassen (1992) indicated, "Constructivism provided a very important vehicle for establishing the dialogue ... the information age and the technological capabilities have caused us to re-conceptualize the learning process and to design new instructional approaches." (p. ix) Constructivists believe that "there are many ways to structure the world, and there are many meanings or perspectives for any event or concept. Thus there is not a correct meaning that we are striving for." (p. 3)

The study of human settings and interactions is a complex task. No two humans hold identical realities or experiences. It is my purpose to better understand what CSCL students have encountered, how they reacted or responded to certain situations, how they interacted with each other, what they perceived as worth knowing and learning, what particular incidences they perceived as worth discussing, and any other reflections they have had.

## Participants

Purposeful sampling method to achieve as maximum a variation as possible within the study population was employed in recruiting participants. As described by Merriam (1998), purposeful sampling is based on the assumption that the researcher wants to discover, understand and gain insight from participants. Therefore, selecting a sample that researcher can learn the most from is important (p. 48).

Study participants were recruited on a volunteer basis. This study focused on four female graduate students including a 47-year-old Caucasian, a 24-year-old Asian, a 36-year-old Hispanic American, and a 32-year-old Indian who were all enrolled in a graduate Web-based CSCL (Computer Supported Collaborative Learning) course offered in Fall 2000 at the University of Texas (UT) College of Education. These participants, registered through UT-Austin (on-campus students) and UT-Brownsville (Tele-campus students), participated in two interview sessions and numerous e-mail communications with the researcher from mid-October to mid-December, 2000.

## Data Collection

For data triangulation, three data sources were obtained: transcripts of interviews; participants' concept maps and explanations; online course data; and transcripts of follow-up telephone or e-mail communications. Additional data were derived from the researcher's observation notes and the reflective journal. Primary data sources include interview transcripts, participants' explanations of their concept maps, and documents obtained directly from participants. Secondary data include online course data chosen by participants, researcher's transcript summaries, and researchers' observation notes and research journal.

Six students were initially requested to participate. Four students among the eight agreed to participate. These participants represented divergent levels of commitment in class as measured by students' online interaction and attendance from September 1<sup>st</sup> to October 1<sup>st</sup> 2000. Informed consent forms were sent to participants via e-mail with the request that they read the form carefully. The consent form that explained the purpose of the study, participation procedures and methods, study timeline, benefits and any known risks of participation, and estimated time involved in the two interview sessions and e-mail communications. The researcher collected and securely filed these forms for future reference.

Prior to the first interview, participants were provided the study focus question: "How did you perceive the group collaboration and knowledge construction work in your CSCL 2000 class?" The participants were ensured of their anonymity in the study and the right to withdraw at any time during the study; participants were continuously asked if they would like to add, delete, or make comments.

Participants were interviewed separately. To ensure that participants' stories remained the sole focus, I explained the basis of naturalistic inquiry prior to the interview, reminded them that their perceptions and experiences were the sole focus of my study, and assured them that they could express themselves freely. To assure that my understanding matched what they had hoped to express, I asked for clarifications and explanations. I asked them to expand and provide examples based solely in response to what they had said and refrained from framing their thoughts by using any pre-determined questions. Throughout the interview, I also summarized what they have said. This emergent interview method shared certain similarities with the active interview process described by Holsten and Gobrium (1995).

To further supplement my understanding, I sometimes drew pictures based on what participants were saying and used to check for clarity and understanding. Holsten and Gobrium discussed a goal of "creative interviewing" techniques as being "a set of techniques for moving past the mere words and sentences exchanged in the interview process." I made sure that the participants could "share their own thoughts and feelings" not only through words, but also symbols (p. 12).

## Data Analysis

Naturalistic inquiry utilizes the researcher as "human instrument." The benefit of this is that data can be collected and analyzed non-linearly and interactively. In this study, data analysis occurred even during the interview. Two interviews per informant were conducted at agreed-upon locations, approximately 2-3 weeks apart. Each interview took approximately one hour. The interviews were audio-taped, transcribed, and organized into summaries. At first interview, participants were presented a printed version of their class online messages and were asked to select messages of their choice and explain the significance. During the first interview, participants expressed their perceptions and experiences based on the focus question and probing questions for explanation, expansion; examples were drawn from participants' responses. At first interview, each participant was asked to

draw a concept map based on the focus question and to present this drawing at the second interview. The first interview summary was sent to participants prior to the second interview.

Interview tapes were first transcribed word-for-word. They were then unitized and coded from either words or phrases used directly by participants or from representative words for the unit information. Two types of coding methods were utilized for each interview transcript. The first method involved detailed frequency counting of particular ideas and subsequent grouping of these ideas into sub-themes. The second coding method was based on concepts that emerged. These two codes were then compared to discern cross-participants' shared themes. Six shared themes emerged and were defined based on the context.

## **Trustworthiness & Authenticity**

Lincoln and Guba (1985) refer to trustworthiness and authenticity as two essential sets of criteria in constructivist research. Trustworthiness (the truth-value, or quality of the findings) refers to the validity and reliability of research issues. It ensures the research methods are correctly conducted. Authenticity refers to fairness, educative, and resulting actions arising from the research (p. 213).

Various methods are often employed to ensure "one has carried out the research process correctly" (Manning, 1997) and increase "the degree of confidence in truth" (Erlandson et al., 1993). The methods I employed to ensure trustworthiness included: writing a "researcher as" statement, purposefully sampling study participants, engaging with participants for an extensive period of time, obtaining more than one data source for data triangulation, forming a peer-debriefing group, and obtaining verifications of participants' interpretations.

To ensure authenticity in my study, informed consent was provided to participants prior to the first interview. In the consent form, participants were informed of the risks of and benefits from participation in the study, as well as their right to withdraw at any time. Prior to the interview, I explained to participants the nature of the study and their rights to freely express any opinions and concerns they may have.

Prior to conducting this study, I composed a "Researcher-as-Instrument Statement" that reflected upon the possible preconceptions or experiences that may possibly have influenced my conduct of this research. In this statement I stated that I was aware of my past notions regarding group work, my personality that may unconsciously influence my expectations and reactions, and my experiences with online learning that may be potentially create bias. Nevertheless, I stated that I expected to remain open and flexible to reassessment of any assumptions that may arise throughout the inquiry process. Cognizant of my interpretations that create sense of my world, I was equally cognizant of my duty to refrain from using words to "frame" participants during the entire research process. I stressed my research position to informants prior to interview. As a sherpa, I had the opportunity to extensively observe online activities, participate in a few group chats, and study the same course materials as all CSCL members. I observed and experienced participants' frustrations, confusions, stresses, and joys.

As suggested by Erlandson (1993), "The researcher should step out of the context being studied to review perceptions, insights, and analyses" (p. 31). Prior to forming my focus question, a peer-debriefing group was formed. The group composed of three peers who were knowledgeable of naturalistic inquiry and who shared similar interests in topics of inquiry. They helped me reconsider, refine, and revise my study, which added to the credibility of this study. We also read each other's transcripts, assisted in evaluating codes and themes during the data analysis process, read the draft version of the study, and provided feedback for revision prior to completion of the study. With their assistance, some decisions and actions were altered through insights gained. We provide each other with both task and emotional support. Often acting as devil's advocates, we met weekly to challenge and assist each other. Detailed minutes of the meetings were kept and served as a resource to be referred to during our inquiry processes.

To ensure that my understandings and interpretations were not biased, three levels of member checking were conducted throughout the inquiry process. The first member check was conducted during the interview process when participants were asked to clarify, explain, expand, and give examples. The second member check was conducted within a few days of each interview when participants were asked to verify the summaries of interviews transcripts. The grand member check was conducted after completion of case reports but prior to submission when participants were asked to confirm the final product. In addition, member checks were also conducted through informal conversations over the telephone and through e-mail. During the entire inquiry process, I also maintained a reflexive journal to record decisions made, reasons for those decisions, actions taken, questions that arose during the process, possible emerging patterns of analysis, and reactions to particular situations.

## **Findings**

To ensure confidentiality, names and locations are changed to preserve the anonymity of the participants. The social relationships documented within remain true to life. The following cases are based on the data obtained from participants in Fall, 2000.

### **Participant information**

Agnes, a 47 year-old Caucasian doctoral student, works part-time at a computer company. She was born and raised in America and has a theater and art background. She received her Master's degree in England. Although Agnes had a few small-scaled online collaborative learning experiences prior to entering CSCL 2000 class, she had never collaborated online.

Nancy, a 24 year-old Taiwanese master's student, works full-time at a primary school in Austin. She was born in Taiwan, but was raised in South America. She moved to America alone when she entered college. She is interested in Computer-Based Training and Assistive-Technology. She had one online collaborative learning experience prior to entering CSCL 2000 class but she thought it was a lot less intensive than this CSCL class.

Elizabeth, a 36 year-old Hispanic-American master's student, works full-time at a primary school in Austin as an Assistant Principal. She was born in Columbia and was raised in America. She is married with a kid and is expecting a baby in 6 months. She had some previous online learning experience prior to entering CSCL 2000 class but have never collaborated online with a group of people. She said she has lots of opportunities to collaborate with colleagues in the face-to-face settings at work.

Angel, a 32 year-old Indian master's student, studies full-time at the University of Texas (U.T.), Austin. Fall 2000 is the first semester for her at U.T. and in America. She already received her Economics master's degree in India prior to entering U.T. and had worked as a high school teacher. She had no previous online learning experience and not much collaborative learning experience.

### **Emerged Themes Across Case**

Six themes emerged through the process of data generation, analysis and comparison of participants: relationships; environment; communication; roles and identities; feelings; and personal variables. Emerged themes were listed in the order of importance as defined by the frequency being discussed.

### **Relationships**

Relationship received the most attention among six emerged themes. For Agnes, group collaboration is a "process." Agnes' group had six people. "You are looking for connections with people," said Agnes. She thought that building relationships online was different because, "connection is often established one way." Agnes conceived that "interpersonal relationships" were important in the dynamics among her knowledge construction, group collaboration, and self-identity (as illustrated in her concept map, Graph #3).

Similar to Agnes, Elizabeth also emphasized much on relationships. During the interviews, Elizabeth repeatedly emphasized the importance of "being responsible for others." She said she did not want to "let down" her group mates. She thought if a person does not have "strong sense of responsibility for others" s/he would not succeed in class. Elizabeth thought it is important to build relationships and friendships in a collaborative learning class where members are held accountable for each other and they had to rely on each other in accomplishing tasks. She described her excitement at the beginning of the semester when she first "met" her virtual officemate online. "Every time I get online, I would check to see if she is there," said Elizabeth. She said the friendship she established with her officemate would last beyond the class.

Nancy and Angel also mentioned about relationships but not emphasized as much as Agnes and Elizabeth. Angel thought everyone has different needs for relationships. She thought that in a collaborative learning course like CSCL, learners are seeking both intellectual as well as emotional connections, however, when there are too many trivial tasks, students tend to just focusing on getting the tasks done rather than learning socio-emotional aspects of learning. Angel said that she was too busy trying to learn different tools and getting use to a new learning environment, she did not spend much time socializing with others.

Similar to Angel, Nancy did not perceive interpersonal relationships as important for her success in class. "The tasks are short, and they have no implications for the future," said Nancy. She said the relationship in class is temporal rather than long-term. Nancy thought interactions in temporal relationships are usually superficial rather than deeper understanding of each other. She thought that people usually react to things differently if they know they are going to have the work relationship for only a few months (a semester).

## **Communication**

The second most discussed theme is communication. Agnes perceived that in online communication context, people do not “have a sense of each other as people.” She said she had to “make efforts to individualize” her messages according to the different perceptions. Agnes saw herself as the “focus of the group” and her group did not “see itself” except in relation to her. She said she would intentionally “disappear for a while” so that her group would put her “in perspective again.”

Agnes thought that an over-reliance on interpretations and assumptions may “mess us up in a terrible way” because in the online situation, they often “try to make meaning immediately by transferring facts and information and make assumptions.” She said some classmates do not express much and they just use some “little symbols” to show their emotions and sometimes it is difficult to really know how they feel. As an example, Agnes recalled when she mistakenly thought a female group member was a man based on the name and the reason that she communicated more fact than emotions. Prior to confirming this “faceless” individual’s gender, Agnes said she had perceived this team member as having a very strong personality and was not moved to confirm this person’s gender until that person issued an apology which was not consistent with the image Agnes held for that person.

Elizabeth perceived positive feedback as an important method for online communication. She said she found herself transferring her communication style in real life to the online learning environment. She said because her role as an assistant principal at work, she often stressed the importance of “team spirit” and showed her appreciation, encouragement, supportive by giving personalized notes to her group mates via private mail. Elizabeth thought that people build relationships through communication and this relationship is reciprocal. “I may not go that extra mile for someone who I feel does not go that extra mile for the group,” said Elizabeth. Similar to Elizabeth, Agnes also mentioned about the reciprocal communication, she thought asynchronous online interaction really lacks immediacy and intimacy.

Communication was Nancy’s major focus among the six themes emerged across participants. Nancy thought the main difference between online and face-to-face collaborative learning was the “sharing of personal lives” and the chances for misunderstandings. She said limitations include: the need for clarifications seemed exponential; miscommunications seemed rampant due to individual interpretations and assumptions; group members seemed to lack an awareness of each others, communication methods seemed to have limitations; misunderstandings seemed to arise from missing cues (verbal, facial, and tone of voice); communication styles and skills seemed to vary widely among members; and communication tools seemed to present challenges of functionality.

Nancy recalled an example where her group was chatting online and some members of the group kept talking about football rather than tasks. As the team leader for that particular task, she tried to get their attention by typing, “Hello, there...!” Surprisingly, one of the group members said she was shouting and the other interpreted the situation as the “cultural gap.” “It had nothing to do with culture, I understood what they were talking about and I have been exposed to football all my life, but let’s just get back to the subject, will we?” said Nancy. “Everything you type in chat is in the middle of my conversation with the others,” Nancy added. She said she did not want to spend many hours online chatting without getting tasks done and as the project leader, she felt responsible to keep the meeting effective and efficient.

Angel also mentioned about people misunderstood her but she said it is important to clarify and negotiate meaning. “It may take some time to get your message across or to understand what others have to say,” said Angel. But she thought if everyone is sincere and sensitive to others’ needs, the trust that build in the group will save a lot of time in later tasks. Similar to Nancy, Angel also observed different types of communication styles in this CSCL environment. They both mentioned that in the online environment, some people are more active while the others are more passive; some are assertive while the others just go with the flow; some feel more comfortable revealing their feelings while others do not reveal their personal lives in the online settings; some were formal while the others were very casual and made jokes or communicated with others through art forms.

## **Roles and identities**

How members of the group identify themselves in the group affect how they act and communicate. For Agnes, knowledge construction and group collaboration are interrelate to herself as a person. Identity is “who I am to myself and what I would take with me no matter what,” said Agnes. She said that there were “very strong identities” in her group and for any given collaborative projects, group members would “jump right in and grab” the tasks they prefer doing. Agnes thought it was good to rotate leadership role in collaborative teams, but guidelines for group leaders should be directed. She stressed that being “assertive” was one of the most important

characteristics that online leaders should possess. She also said these leaders should be, “very organized,” consistent; “responsible,” and “active in participation,” and one who “keeps others organized to a certain level.”

Nancy said that roles and responsibilities within the group should be well-defined. “Collaboration should be done in a way that everyone knows their roles,” said Nancy. Nancy said there were some “overlapping work and gaps” in her group. She thought that it is very important to “align people and their roles very carefully.” Nancy said that in a group, “people are from different kinds of backgrounds” but “diversity works well only if everyone knew his or her roles and responsibilities” and if they have “positive attitudes.” She said that a successful group should have strong leadership. Nancy recalled her experience being the project leader for one module and said one of the most challenging things was that “everyone’s concept of time is different” and being at the forefront having certain responsibilities in “making sure everything is fine,” she said it required certain skills. She said if a leader tried to “control” and hold “power” rather than “lead,” then that person was “not doing a leader’s job.” Rather, the person was “doing authoritarian work.” Similar to Nancy, Angel thought it was important to have well-defined roles and responsibilities. She said the course did not give clear guidelines because the course expect students to take turns performing leadership roles while everyone holds different concepts and expectations toward leadership role. She said that one of the big challenges in any group collaboration is the distribution of work. Those who are leaders will naturally take on more work while others may just laid back and become less involved.

Elizabeth said she identified herself as a part of the whole group. She described her feeling of “togetherness” and having mutual goals helped her get focused. “Our suite is a little society and out chat is kind of like the town meeting,” said Elizabeth. She said that because the group “struggled together” in completing tasks throughout the semester, they build that sense of “togetherness” and “team cohesiveness.” Elizabeth thought the term, “leader” should be called something else in the online collaborative learning environment because there could be multiple leaders in a group. She said some members are better at making decisions while others may be good at communicating with others; some are good at finding resources while others may be good at organizing various ideas; some are good at keeping members on track while others may bring the group joy and cheer everyone up when the group is stressed.

## **Environment**

Participants referred “environment” as the course virtual workspace and the people involved. Agnes thought that the “patterns of relationships” have strong connection with the environment they find themselves in and that this CSCL environment was largely crafted by the instructor and technology. She said, “Life imitates art.” Agnes believed that, “all thought internal is first modeled through the relationships occurring externally.” She thought our “consciousness comes after relationships” and “dialogue comes before internal monologue.” Agnes suggested that CSCL instructors, when designing their courses, should “create a safe environment” so that students would not “just project their meanings on everything” but would “take risks” and “experience the new meaning and new structures.” Instructors should also consider their own “values” because instructors are “part of the big environment” and their values impact how students experience the process, she said.

Elizabeth perceived the course environment as a place where people “come together” to make friends and accomplish tasks. Due to the various tools used in the course, Elizabeth perceived environment as multiple places. She said she was often confused by too many places to go to interact with others and to work through assignments. Angel perceived the environment as a very structured place where students learn, interact with others, and accomplish tasks. Nancy viewed the environment as a “big open communication space” where people just come together and collaborate on a variety of projects. She said, “supervision is required.” Students need to “have enough guidance” rather than just being “left alone” and there should be “some kind of facilitator or mediator to solve conflicts” and to “encourage people to be more honest with each other.”

Angel said the course was very well-structured and there were many intensive tasks they had to accomplish. The course expected students to log-on everyday and arranged one “sherpa” in each team. However, “sherpas” have different styles, knowledge, status, and access to specifications about the course. When members of the group encounter problem, they look up to “sherpas” to answer their questions immediately and take the leadership role to guide their work. She said her group “sherpa was very encouraging and cheerful” but she said most class members expect to have more frequent and consistent feedback from sherpas and they need feedback on their progress from the instructor. The course designed many interactive activities for members to collaborate, but there seemed to be lack of interaction between students and sherpas and between students and the instructor.

## **Feelings**

Participants expressed feelings of uncertainty, stress, frustration, and alienation. Agnes said she felt “alienated from others” and “unbelievably stressed” because of the “tight schedule” and the “nature of the work.” Agnes said she likes to “be around people” but her frustration came from needing “to be with people” and “to do works that have meaning.” Agnes expressed her hopes, fears, and worries: “I worry that we are bringing our old solutions to the new forms.” She challenged Web-based instructors to deliberate on a question: “Will people realize their potential for humanitarian action or be seduced by the flavor of power and reduce further our chances to create a joyful world?”

All participants shared similar feelings of stress and uncertainty in this Web-based CSCL class. Agnes said that she did not know what others were thinking and feeling because feedback was either delayed or non-existent. “There are many things that you can’t predict,” said Nancy. She said she was not sure that “true feelings” were routinely expressed online. “People would be greeting each other or whatever, but you don’t know if they meant it or just typed it,” Nancy added.

Elizabeth and Angel expressed feelings of confusion and frustration. Elizabeth said, “You have to go to different places to get one piece of information sometimes.” She suggested that the navigation should be as simple as possible for users rather than offering multiple—and confusing—paths for users. Angel recalled her difficulty accessing the computer. She said because it was her first semester in a foreign country, she did not have a computer. The University libraries often close on holidays so she could not do the work. Angel said she sometimes became frustrated when some TeachNet functions did not access from the Web or when the server would go down.

### **Personal variables**

Agnes thought personal factors influence understanding, thinking, and experiences in any given setting because, “Everything is a system. A person is a system. When they enter a relationship or an environment, they bring in wherever they are at.” Agnes described her group as a meeting place where “the full personality drama” occurred and where everyone diverged in their “working and writing styles.” Agnes thought, “some people are more comfortable with patriarchal hierarchies” which, she said, is not based on ethnicity or gender. Like Agnes, Nancy also perceived that personal variables influenced online collaboration. She observed differences in personalities, preferences, interests, values, cultural backgrounds, communication styles, and working styles. Nancy said that she tried to “guess” what others’ personalities were and attempted to “accommodate” their personalities based on “their contributions.” She observed that everyone in her group differed in their priorities, in their reactions, and their modes of thinking, collaborating, communicating, and writing. Nancy thought her family upbringing also affects how she interacted with others. “I prefer people do what they are comfortable with,” said Nancy. She thought that, “there should be one person taking the lead and others follow.”

Elizabeth and Angel also expressed how their family upbringing affected their online behavior. Elizabeth said her family emphasizes responsibility and the importance of maintaining public decorum. She said living with extended family members is part of her culture, and from being exposed to various family members with multiple perspectives, she learned to accept and respect others’ point of views more readily. Angel said in India, men and women are normally separated throughout primary and secondary education and the society is structured hierarchically. She said that because she often had to solve problems by herself while growing up, every time she encountered difficulties in the CSCL class she would attempt to solve problems by herself rather than seek help.

### **Conclusion and Future Implications**

The findings of this study suggest that participants perceived communication and interpersonal relationships as two major areas of concern in the online group collaborative learning environment. Future studies should focus on the social aspects of interactions in the Web-based computer supported learning environment. Further, the implementation process should be closely examined in order to gain a better understanding of how various learners define knowledge, how knowledge is communicated and negotiated among learners of diverse backgrounds, and how knowledge is constructed as the result of communication and negotiation.

Due to the nature of collaboration and the necessity to negotiate toward shared meanings, online collaborators reported spending a considerable amount of time attempting to understand, check, confirm, coordinate, and negotiate with group members. Future studies should focus on strategies utilized by experienced on-line collaborative learners to facilitate and ensure effective and efficient communication. In this study, participants suggested that in order to make the group decision-making process easier and results more meaningful, individuals should clearly state their expectations, be cognizant of the various cultural and individual notions of time and

responsibility, be sensitive to others' perspectives and needs, and communicate frequently with group members to resolve conflicts.

Based on my findings and observations, the following is a list of eight suggestions for Web-based instructors to consider as they design online collaborative learning courses:

1. **Assumptions and Interpretations:** Both students and the instructor should be cognizant of their preconceptions, expectations, and possible assumptions. Our focus of attention and our behavior are both heavily influenced by what we know and how we know it.
2. **Social Aspects of Learning:** The social aspects of learning should be emphasized as much as the cognitive/ intellectual aspects of learning. The course instructor should understand the importance of designing activities that facilitate social interactions as well as the importance of constantly providing to and requesting feedback from learners.
3. **Positive Attitude:** Members of the community should maintain positive attitudes and strive to be open and flexible while understanding that learning is an ever-evolving process.
4. **Modeling:** The instructor should guide, coach, and facilitate learning by providing instant feedback. If the instructor expects learners to check-in everyday, he/she should do the same. Instructor and staff policies should be consistently applied to all members of the community.
5. **Real and Humanized Instruction:** The main emphasis of learning tasks should be on humans, not tools. Tasks that require students to mechanically perform procedures may not offer meaningful learning to learners.
6. **Process and Product:** The process of knowledge acquisition and group interactions should be evaluated as stringently as the final product. Since the human mind evolves through a process of perceptions altered by experience, how learners undergo knowledge construction and group collaboration are as important as the resultant product.
7. **Performance Assessment:** Learners should be held accountable—but accountability should be consistent and justifiable. How process can be evaluated should be incorporated and considered in performance assessments.
8. **Safe Environment:** An environment of fear, envy, and anger is detrimental to learning. Conversely, an environment of joy, mutual respect, and sympathy is conducive to learning. Learning is promoted in an environment where students are ensured free expression, are enabled to make mistakes because mistakes are explicitly viewed as acceptable inevitabilities in knowledge construction, are inspired and encouraged by peers and instructor, and are intellectually challenged.

## References

- Dewey, J. (1938). *Experience and education*. New Jersey: Collier Book.
- Erlanson, D. A., Harris, E. L., Skipper, B. L., Allen, S. D. (1993). *Doing naturalistic inquiry*. Newbury Park, CA: Sage Publications.
- Resta, P. E., Christal, M., Ferneding, K., Puthoff, A. K. (1999). *CSCCL as a catalyst for changing teacher practice*. Paper presented at the Computer Supported Collaborative Learning, Palo Alto, CA: Stanford University.
- Dodge, B. *Site Overview: WebQuest*. Available: <http://edweb.sdsu.edu/webquest/overview.htm> [2001, Nov. 1].
- Guba, E. G. (1981). Criteria for assessing the trustworthiness of naturalistic inquiries. *Educational Communication and Technology Journal*, 29, 75-92.
- Fosnot, C. T. (1996). Constructivism: A psychological theory of learning. In C. T. Fosnot (Ed.), *Constructivism: Theory, Perspectives, and Practice*. MA: Teachers College, Columbia University.
- Jonassen, D. *Constructivism*, [World Wide Web]. Available: <http://www.coe.uh.edu/~ichen/ebook/ET-IT/constr.htm> [2001, June 29].
- Duffy, T. M. J., D. H. (1992). *Constructivism and the technology of instruction*. New York: Lawrence Erlbaum Associations, Publishers.
- Holstein, J. A., Gubrium, J. F. (1995). *The active interview*. CA: Thousand Oaks, Sage Publications.
- Lincoln, Y. S., Guba, E. G. (1985). *Naturalistic inquiry*. CA: Beverly Hills, Sage Publications.
- Manning, K. (1997). Authenticity in constructivist inquiry: Methodological considerations without prescription. *Qualitative inquiry*, 3(1), 93-115.



# Handshakes in Cyberspace: Bridging the Cultural Differences Through Effective Intercultural Communication and Collaboration

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## Abstract

*In the online learning environment, communication and collaboration occur from a distance. In the absence of non-verbal communication cues (such as facial expressions, gestures, and tone of voice), understanding, communication, and interaction rest largely on individual assumptions and interpretations. The magnitude of these communication challenges increases as cultural differences among communicators widen.*

*The purposes of this study are to (1) discuss the role of effective intercultural communication and collaboration in the Web-based collaborative learning community, (2) examine helpful strategies utilized by both instructors and learners in a Web-based curriculum model where diversity is treated as a fact and collaboration among learners of diverse backgrounds as the norm, and (3) discuss future implications for integrating technology into curriculum targeted to global learning populations.*

## Introduction

The Internet has provided the possibility to erase geographic and interpersonal boundaries among people of diverse backgrounds, has created opportunities for widespread electronic delivery of news, information, and curriculum, and has altered the way we communicate, share knowledge, deliver education, and conduct business. Globally, market expansion and course offerings are increasingly assisted by use of the Internet. In education, the Internet has been widely used in preparing learners for “future responsibilities” and “success in life” (Dewey, 1938, p. 17). Cross-nation collaborative projects on the Internet across disciplines have exponentially increased internationally in recent years.

Amidst the hype of cutting-edge technology, however, it is often overlooked that computers do not think, only humans do; computers do not have agency, humans do; technological difficulties do not limit intellectual advancement, humans do. Technology potentially provides an array of resources, but also presents constraints. Indeed, humans ultimately decide how to utilize new technologies, and these decisions are often based on both proven (or unproven) and discovered strategies. To integrate technology into instruction and learning, it is essential to focus on human needs, strategies, perceptions, and experiences communicating and collaborating in the cyber-learning environment — rather than solely on the functionality of technological tools.

As Web-based learning communities and online school partnership projects exponentially expand globally, effective intercultural communication and collaboration is, as never before, of vital significance. Web-based instruction provides opportunities for a diverse body of individuals to interact. In order to suit individual learner’s needs while optimizing their strengths and talents, Confucius said, instruction should be tailored to meet individual learner’s needs. While instructors are challenged to understand and be sensitive to the needs of learners in their design and implementation of Web-based courses, learners’ success hinges not only on their willingness, attitude, and devotion to achieve shared goals in a sea of information, but also on how they handle the challenges of consolidating fellow learning community members’ multiple views, perspectives, and approaches.

Based on my Web-based collaborative learning curriculum model experiences as a student, researcher, moderator, instructional designer, and teaching assistant, this paper intends to explore how effective communication and collaboration among members of diverse backgrounds may be encouraged in the design and implementation process and to explore what intercultural communication techniques may be or have been utilized by members in the Web-based learning community in bridging differences, achieving group goals, and optimizing individual learning.

## Web-Based Instruction: Opportunities and Challenges

The development of computer network technology provides opportunities for dynamic human contact and collaboration. Teachers at all instructional levels are learning and integrating technology into curriculum and instruction. Internet access in public schools and instructional sites in America has increased from 35 percent in 1994 to 89 percent in 1998 and is expected to grow further. Student computer use has also increased from 27.3 percent in 1984 to 68.8 percent in 1997. These changes represent increases of 10.3 percent at the Pre-K level, 10.4 percent in grades 1-8, 12.3 percent in grades 9-12, 9.5 percent at the college level, and 3.4 percent at the graduate

school level (U.S. Department of Commerce, 1998). Major reasons for this rapid growth include technology's capacity for reaching remote locations while providing immediate and engaging communication, its promise of collaborative opportunities, and the human need for connection and interaction.

The Internet is a global society involving users of diverse backgrounds, and this global society is comprised of various communities with cultures of their own. This Internet society is constantly evolving due to the evolution of tools and stakeholders involved. In this society where people communicate to collaborate the methods of communication and collaboration evolve with the evolution of technological tools and the dynamics of human interactions.

Web-based instruction has often been implemented to supplement, enhance, and transform existing curriculum. Some instructors use the Web to post syllabus online, to supplement face-to-face class teaching, to broaden the scope of their instruction, or to deliver courses in their entirety. Many distance-learning courses, however, have encountered high attrition rates (Abdul-Rahman, 1994; Galusha, 1997), unequal participation and individual commitment, role ambiguity in group contexts, absenteeism, inattention to social relationships, and students feeling overwhelmed (O'Hara-Devereaux&Johnsen, 1994). The viability of effective communication and collaboration in the absence of face-to-face interaction has been questioned (Handy, 1995). When students find course content irrelevant, perceive the environment as impersonal, can not obtain immediate technical or instructional assistance or timely instructor feedback, and feel disconnected from fellow learners, they may feel isolated, unmotivated, or unchallenged. These shortcomings originate from a lack of understanding and sensitivity to the dynamics of human interaction and the nature of human learning.

In the following section, I will first explore topics related to community-building, cooperative and collaborative learning, culture and communication, and intercultural communication as they relate to the curriculum model examined and the purpose of this study. Then, I will examine a Web-based curriculum model based on my two years experience as student, researcher, moderator, instructional designer, and teaching assistant within this model. Finally, I will discuss implications for future global Web-based learning curriculum.

### **Community Building & Web-Based Learning**

Despite Thoreau's fervent wish for solitude while at Walden Pond (Thoreau, 1996), the effects of isolation are so powerful that isolation is a potent punishment technique. Parents and teachers isolate misbehaving children. Hostages are held in isolation, as are miscreant prisoners. Most of us cannot tolerate enclosure without contact for very long; we crave company to belong to and share with, and love is as necessary as the air we breathe. Similarly, contact is often necessary to accomplish our goals; communication is essential to our pursuit of achievement as social beings.

In "My Pedagogic Creed" (1929), Dewey said, "The educational process has two sides, one psychological and one sociological." Dewey emphasized the social aspect of learning. Dewey thought some schools failed because they neglected "the school as a form of community life." Educators are aware of and have been utilizing the power of people working together to build a "community of learners." Increasingly, this notion has been re-emphasized with the advance in technology and global network. "The community is something that happens. It happens when people speak to one another and listen to one another in an effort to discern the truth and to discover themselves in the process. It happens only in an environment of freedom and openness. Community happens only in an atmosphere of honesty and tolerance. Community happens when people care about one another and when they are willing to take responsibility for themselves as well as for each other," said Robert Berdahl, the chancellor of the University of California at Berkeley (Berdahl, 1998). It can be inferred from Berdahl's commentary that communication and collaboration are essential for community building.

Communities are essential in human history. We have constantly sought to survive collectively, to belong, to care, and to support each other. Various forms of communication and culture are often established in the community to maintain cooperation and collaboration. Maurice Friedman (1983) distinguished two kinds of community: a community of affinity, which refers to a group of "like-minded" people who have come together for security, and a community of otherness, which refers to when members of the group are not alike, but when they share common concerns. Within a particular virtual community (a form of network organization through the use of technological tools), people share "common concerns." They are not necessarily "like-minded" and while the same beliefs and values may not be commonly shared, certain visions, concerns, or goals are shared (Friedman, 1983).

Many educators believe that learning is more effective when collaborating students encounter conflicts (Piaget, 1977; Doise & Mugny, 1984; Savery & Duffy, 1996). According to these educators, educational, social, and cultural background differences are not necessarily negative, but rather, through interactions among different

people new thoughts and critical thinking and analysis are inspired and opportunities for individuals to gain insights are provided.

The richness of multiple perspectives in the Web-based learning environment, if fully nurtured, can help spur the formation of rich and innovative perspectives. Conflicts are positive when collaborators communicate and negotiate to reach a shared understanding, discover new paths, and construct new thoughts and ideas together. Sharing, exchanging, and negotiating provide learners opportunities to deepen their understanding. During the process of communication and collaboration in knowledge acquisition, negotiation, decision-making, and knowledge construction, learners hopefully slough off their unconscious reliance on preconceptions, biases, unproven interpretations, and assumptions.

### **Cooperative and Collaborative Learning**

According to the 1999 U.S. Department of Commerce report, "21st Century Skills for 21st Century Jobs," the proportion of skilled in the workforce increased from 20 percent in 1950 to 60 percent in 1997 while the proportion non-skilled laborers in the workforce decreased from 60 percent to 20 percent illustrating that the demand for skilled workers has dramatically increased over the past half century while the demand for unskilled laborers has dramatically decreased. In this new economy, Fortune 500 companies regard "teamwork," as the most critical job in the 21<sup>st</sup> century skill. Concomitantly, the ability to cooperate, collaborate and work well with others is considered more important than basic skills (such as reading and writing) that traditional schools have long defined as being most important (21st Century Skills, 1999, p. 1).

Studies consistently indicate that cooperative and collaborative learning are not only effective in generating positive outcomes in academic performance, but are also influential in affective and social aspects of learning (Johnson, Johnson, & Smith, 1998; Slavin, 1991, Harasim, 1990). "When the classroom is structured in a way that allows students to work cooperatively on learning tasks, students benefit academically as well as socially," Slavin (1987) said in extolling the benefits of cooperative and collaborative learning.

Cooperation creates possibilities. As Fosnot, (1996) said, "As ideas are shared within a community, new possibilities are suggested to the individual for consideration. These multiple perspectives may offer a new set of correspondences, and at times even contradictions, to individual constructions." (Fosnot, 1996, p. 27) Johnson and Johnson (1990) concluded that, "Achievement is higher in cooperative situations than in competitive or individualistic ones and cooperative efforts result in more frequent use of higher-level reasoning strategies, more frequent process gain, and higher performance on subsequent tests taken individually (group-to-individual transfer) than do competitive or individualistic efforts" (Johnson & Johnson, 1991).

"Groups pull and tug. They pull between tasks to accomplish and work to produce, but they also tug to maintain cohesiveness and an optimal level of morale." (Schmuck & Schmuck, 1997, p. 263) Working in a group can be irritating and frustrating. While differences in knowledge and skills may influence overall results, major challenges and problems to cooperation and collaboration come from differences in attitudes and in individuals' willingness to communicate, negotiate, change, commit, and take responsibility — rather than superficial differences in gender, ethnicity, race, class, religion, or culture.

### **Culture and Communication**

Mirroring the American community, public school students represent an array of cultural backgrounds. Globalization has widened the need for intercultural communication and collaboration. Dodd & Montalvo (1987) identified intercultural effectiveness as a desirable skill essential in creating a productive and non-threatening communication climate marked by non-dogmatic openness and innovation. Researchers have noted the limitations of and misunderstandings in cross-cultural dialogue, the importance of cross-cultural learning, and the necessity of being culturally sensitive and responsive (McLoughlin, 1999).

With ample knowledge and strategies, technological tools are the means rather than ends to goals we want to achieve. Given the importance of global communication and collaboration, it is essential to assess what we can do to bridge the differences among members in the community and to establish culturally sensitive curriculum suitable for learners of diverse backgrounds.

Culture and communication are intertwined and interdependent. Culture influences the way we make meaning, interpret, and communicate messages. Culture is complex and involves a plethora of systems. As described by Carley H. Dodd, "Culture is like a kaleidoscope with similar shapes but different colors, or at other times, with different shapes but similar colors" (Dodd, 1991, p. 12). Culture is often described as the dynamic interplay between the experiences of people and the social structure at large (Giroux, 1997; Collier, 1998; Grossberg

1992; Grossberg, 1997; Marcus and Shannon, 1997). Culture is the societal situation strained through the mesh of individual perception. This dichotomy is almost paradoxical in that culture is, in some ways, unique to the individual yet shared by a community. One's identification with a culture comes from the "sameness" that is shared with others.

Cultural differences, as referred to in this paper, are not limited merely to differences in ethnicity or nationality. Cultural differences indicate "patterns of thinking, feeling, and acting." (Hofstede, 1997, p. 5) A group holding the same "shared constructions" (Erlandson, et.al.,1993, p. 24) represents a culture of its own. Those unfamiliar with the online learning "culture" may easily get lost in the cyber environment and feel isolated. Those ignorant of their own and other's culture may feel isolated within a collaboration environment. Those unwilling to be open to and respectful of multiple perspectives, accepting of ambiguities or uncertainties, flexible, and sensitive and mindful of cultural communication differences may encounter difficulties in the collaborative learning environment.

Collier (1998) characterized cultural identities as historical, contextual, and relational constructions that have "enduring" and "changing" properties. Cultural identities emerge in everyday discourse and in social practices, as well as by rituals, norms, and myths that are handed down to new members (Collier 1998). Because of mobility, greater accessibility of information, and expanded multi-group membership, the stereotypical generalizations has become increasingly invalid. Most people belong to multiple groups (both voluntary and not). Dodd suggests that the "macrocultural system" needs to be considered as well as the "subcultural differences" (Dodd 1991) when we look at individuals interacting in a cultural context. While the society in which an individual is situated largely influences one's "macrocultural" perspective, the individual nature of culture lies in the uniqueness of the "subcultures" to which one belongs.

In the online learning environment, knowledge acquisition and group collaboration differ from personal encounters. In this environment, learners map their way through the process as they communicate from remote sites. When nonverbal communication cues such as facial expressions, gestures, and tone of voice are largely absent, the frequency of communication and the reliance on interpretation increases. Effective communication and collaboration in the cyberspace requires patience and tolerance as members work to understand one another in accomplishing group and individual goals. Gudykunst (1994), in describing effective in-group communication, said, "When there is a lack of connection between the participants, community cannot develop. For community to develop, dialogue is necessary. Dialogue involves communication between individuals. In a dialogue, each participant's feeling of control and ownership is minimized; each participant confirms the other, even when conflict occurs" (p. 223). Interpersonal relationships are essential for effective communication among members of the group. D.W. Johnson & R.T. Johnson (1975) suggested a few interpersonal processes and patterns of interaction within the structure of a cooperative learning environment: mutual liking; effective communication; utilization of fellow students as resources, division of labor, and divergent and risk-taking thinking. They also added that high interactions, trust, mutual influence, acceptance and support, emotional involvement, and coordination of effort are also essential.

Collis (1999) proposed that cultural sensitivity should be a cornerstone in the design of Web-based courses because culture influences the acceptance, use, and impact of learning resources. Culture affects the individual's response to computer-related system (Collis 1999). Among Collis' suggestions, I find the following points important in designing a culturally sensitive course: (1) creating an atmosphere of non-critical acceptance of ideas; (2) moving from deficit-model thinking where the students begin with a deficiency in terms of a lack of pre-defined knowledge to a socially participative model where the students learn through communicative interaction with others that includes horizontal communication among students as well as vertical communication among the facilitators and students; (3) accepting tone and style differences in communication; (4) grouping of users to facilitate competence and comfort; (5) appropriately allocating responsibilities among students and facilitators; (6) accepting results of trial and error in course design; and (7) discarding the idea that learning or acting differently is unacceptable. Collis (1999) concludes that institutions and instructors will not only need to improve their insight into cultural differences that affect teaching and learning, but will also need to form these insights into manageable ways to respond to multiple cultures.

### **Bridging the Differences: A Web-Based Curriculum Model**

This paper examined a Web-based Computer Supported Collaborative Learning (CSCL) curriculum model at the University of Texas at Austin. This model treats diversity as a fact and collaboration as fundamental for knowledge construction through the provision of rich information and resources to learners. In this model, multiple perspectives are valued. Students engaged in activities where knowledge is constructed through negotiation among

collaborators from diverse backgrounds within the community. Group diversity is also carefully considered in forming collaborative virtual teams. Students were first asked to indicate their preferences based on their interests. Factors such as ethnicity, gender, computer skills, and geographic locations were then considered in building virtual teams.

This curriculum model, initiated by Dr. Paul E. Resta at the University of Texas at Austin, invited a group of graduate students from diverse backgrounds with various strengths and talents to participate in the course design, development, implementation, evaluation, and revision processes. Reflecting the diverse student body – and the collaborative nature of the course – these graduate students from diverse cultural backgrounds and expertise collaborate to design and improve the course throughout the curriculum development and implementation process. The course is based on an on-going revision process where researchers meet on a regular basis to share observations in order to improve the course.

*Graph #1*



*Graph #2*



Courses in this model are situated in the virtual environment where students “meet” through online communication and interaction. A virtual environment with collaborative tasks was created based on the metaphor of a hypothetical technology company, school district, or educational technology institute (See *Graph #1* for example of virtual workspace). Students are divided into groups representing a department within a company, a school within the district, or an educational sector within an institute. Problem- and project-based approaches to learning were employed. In these courses, students must collaboratively complete a technology plan, write a grant proposal, or design a CSCL course based on many structured tasks. To accomplish course requirements, online socialization and communication are essential, as are extensive cooperation and collaboration, among learners of diverse backgrounds.

Many online tools are provided to students to support the development of their projects. The course content with rich information and resource links is provided on the Web via a courseware (WebCT, Vcampus, or Prometheus), while class discussions and interactions take place at a virtual platform on TeachNet via FirstClass groupware. For synchronous interaction, the online chat function is employed. Learners participate in monthly Webcast (videoconference) on campus (face-to-face) or by way of network accessing (see *Graph #2* for example), which serve as a monthly forum for guest experts’ discussion of relevant topics, teams to share their work, and the instructor to answer student questions or give advice. Courses are divided into modules; module tasks progress from simple to complex. Learners are either on-campus students at the University of Texas at Austin or distance-learning students from across Texas and the United States. On-campus students have the option of meeting the instructor, staff, and peers face-to-face or through the Internet, while off-campus students can interact only via the network and phone communication.

### **Communication: Challenges and Strategies Employed**

Communication in the Web-based collaborative learning environment includes both task and social aspects. Due to communication limitations, online collaborators easily spend a large portion of time understanding, checking,

confirming, coordinating, and negotiating to obtain mutual understandings and to construct shared knowledge. With the limitations in Web-based communication tools and the resultant reliance on interpretations and assumptions, effective communication among learners of diverse backgrounds is very challenging. A few examples of Web design that may be open to cultural interpretation include: various expectations for communication (some learners may expect daily communication from others in the team while others are not accustomed to communicating online), the amount and type of information desired and required (some learners may expect explicit information while others who are accustomed to implicit expression do not feel comfortable being direct), communication styles and preferences (some prefer to take turns, some like to jump to conclusions, while others like to wait for cues), level of task orientation (some are task-driven high achievers while others take a laid-back position), variation in understandings (some are from the culture where the course is situated while others may situate in a completely different culture), group orientations (some prefer and have experience working in groups while others prefer competition rather than collaboration), and group dynamics (some cultures may look to a leader for direction while others work better when there is no single leader in the group).

As opposed to face-to-face settings where communicators are recognized as human, in the Web environment, people are often objectified and largely recognized by name. As opposed to face-to-face settings that are conducted naturally, in the Web environment, there is usually a 45 seconds time lag between event and broadcast. As opposed to face-to-face settings where it is possible to drag a person aside and whisper in privacy, in online chat, this is not possible because everyone shares the same space. As opposed to face-to-face settings where communicators can choose their focus of attention (or inattention), in the video-conferencing environment, the camera setting dictates viewers' attention.

In my previous study entitled, "Multiplicity and flexibility as design features – A case study of a Web-based collaborative learning community for diverse learners" (to be published in the Computer Supported Collaborative Learning 2002 conference proceeding), I identify multiplicity and flexibility as two key course design features essential for meeting the needs of students from diverse backgrounds. As a teaching assistant, I worked closely with the instructor and learners and observed the course while assisting in its implementation. A few course aspects were highlighted to illustrate multiplicity and flexibility: course content and structure; communication tools, channels, and types; support, accessibility, and feedback; and performance assessment. Multiplicity refers to the multiple ways of presenting and delivering course material, channels of communication, activity offerings, and learning strategies. Flexibility refers to the welcoming of and openness to questions and suggestions, timely support, options for learning tasks, and provision of individualized feedback throughout the course.

The provision of multiple learning options is critical to enable deeper understandings among students from various cultural and social backgrounds who hold widely divergent individual values and interests. Multiple course representation methods were employed to meet the needs of multiple users. These representations included text, audio, video, and simulation, as well as multiple learning contexts and strategies. This curriculum model provided options in some assignments. For example, in one of the classes offered, students had the options of type of medium and their focus in an assignment regarding leadership visions. Some students chose film, others chose print, while others drew from their own experiences. A Korean student chose to write about her president while another Caucasian student chose a female leader because she said that female leaders have been largely unheralded. The provision of options gave students of diverse cultures, needs, and values the opportunity to situate their learning in the context of their culture or values in order to achieve deeper understandings. As no plan is perfect, adjustments to the course content and schedule were necessary throughout the implementation process. Reflecting the flexibility of this course to meet the needs of diverse learners, approaches, methods, and schedules were adjusted and alternatives provided when technological failures or technical setbacks occurred or to accommodate learners' unforeseen personal problems and difficulties.

In the required end-of-module learning reflections, learners in this curriculum model indicated a few effective strategies for online collaboration within this model. These strategies include: ensuring the technical aspects (such as necessary software downloads) are solved upon initial entry; employing frequent and cumulative check-ins to ensure optimal participation; ensuring adequate time for ice-breaking and team-building to facilitate team coherence and success; providing positive, constructive feedback and encouragement to peers; establishing multiple leadership roles; and setting meeting agendas for effective decision-making and collaboration. Students also indicated that equally essential strategies essential for online collaborative success were taking initiatives on tasks, honestly and sincerely communicating needs and intentions, and encouraging risk-taking by celebrating multiple perspectives. A few learners indicated that language is often the major challenge for students whose native language is not English because culturally related idioms and slang used. These non-native English-speaking students suggested that language deficiency is an invalid basis for judging other because an individual's talents are simply masked by language deficiencies. Indeed, many non-native English-speaking students reported gaining

confidence in their communication abilities as the course progressed, illustrating the positive effect of collaboration in bringing out the multiple talents of diverse learners. Many students suggested that it is important to be sensitive to other's needs, encourage participation, and to provide positive feedback. Learners further suggested that regular contributions from all group members is essential to members' feelings of connection and sense of community, as well as to the completion of tasks.

## Conclusion

In light of the global community spawned by the World-Wide-Web and the increased preponderance of global Web-based learning communities through cyber instruction, this paper discusses why culture and communication are important considerations when designing and implementing Web-based collaborative learning communities. Based on a Web-based CSCL curriculum model, this paper discusses some strategies employed by the instructor and instructional designers to enhance the design and implementation of the course to optimize individual and group learning among learners of diverse backgrounds; to facilitate class communication as well as by learners of the community to better collaborating with peers with various patterns of thinking, frames of mind, and school of thoughts.

Communication among people of congruent cultures, societies, and backgrounds – or even from the same family – is challenging. Communication among people of different cultures, societies, and backgrounds is even more challenging. Collaborative communication across cultures in the online learning environment requires the willingness of community members to listen, to respect, and to accept different perspectives; to accommodate and negotiate in order to reach shared meanings; to be flexible in their acceptance of ambiguities; to provide mutual respect, trust, and support; to develop cultural sensitivity and to understand the value of multiple perspectives; to negotiate shared meanings; to obtain mutual understanding, and to reach consensus for the achievement of the shared goals and needs.

Given the diversity of the global Internet society, cultural sensitivity and flexibility are essential to collaborative virtual classroom success. Future studies should focus on the needs of learners from diverse cultures in the design and implementation of virtual curriculum and in virtual classroom intercultural communication and collaboration. Web-based instructional designers, instructors, and moderators should employ multiple approaches and strategies in designing, developing, and implementing their courses and in assessing students – while always keeping in mind the needs of learners from diverse backgrounds – to inspire and encourage constructive work. Cultural sensitivity may assist in bridging the cultural diversities and contributing to overall course success. Building global communities of diverse learners requires that courses not simply represent an autocratic instructor's curriculum in the absence of consideration of multiple needs and resources; the ideal curriculum should consider multiple perspectives, provide multiple communication and learning styles, and allow a high level of flexibility.

As the Chinese philosopher and educator Confucius said, "Education should be provided indiscriminately. Teaching should be tailored discriminately." This implies the dual notions of equal opportunity among learners under instruction tailored to the needs of individual students. For optimum learning to occur, instructors should be cognizant of cultural differences, but also should also cognizant of the challenges to intercultural communication and the need to be sensitive to the diverse needs of learners during the process of instruction. For optimum learning to occur, experienced experts' strategies of tailoring instructions to learners' needs and facilitation of group interaction need to be shared.

Web-based instructors of diverse student bodies face the same challenge as Chinese cooks – it's all in the mix. Just as Chinese cooks need to know the functions of various ingredients, instructors need to know the strengths and weaknesses of various learners. Just as Chinese cooks need to know the combined effect of various components, instructors need to know how to maximize the divergent abilities of learners. Just as Chinese cooks need to temper the use of spices, temperature, and cooking time, instructors need to temper the pace and demands of instructional strategies. Without these sensitivities, optimal performance cannot be attained.

## Reference

- Abdul-Rahman, Z. (1994). *Factors related to completion of distance education courses in the off-campus degree program at the University Sains of Malaysia (Student Attrition)*. Unpublished Doctoral dissertation, North Carolina State University.
- Berdahl, R. M. (1998). *On the threshold of the twenty-first century*, [Web]. Zellerbach Hall, U.C. Berkeley. Available: <http://www.chance.berkeley.edu/cio/chancellor/sp/inaug.html> [2000, Oct.].

- Collis, B. (1999). Designing for differences: Cultural issues in the design of WWW-based course-support sites. *British Journal of Educational Technology*, 30(3), 201-215.
- Doise, W., Mugny, G. (1984). *The social development of the intellect*. Oxford: Pergamon Press.
- Dewey, J. (1929). My pedagogic creed. *Journal of the National Education Association*, 18(9), 291-195.
- Dewey, J. (1938). *Experience and education*. New Jersey: Collier Book.
- Dodd, C. H. (1991). *Dynamics of intercultural communication* (3rd ed.). Dubuque, Iowa: Wm. C. Brown Publishers.
- Erlandson, D. A., Harris, E. L., Skipper, B. L., Allen, S. D. (1993). *Doing naturalistic inquiry*. Newbury Park, CA: Sage Publications.
- Friedman, M. (1983). *The confirmation of otherness: In family, community and society*. New York: Pilgrim Press.
- Glusha, J. M. (1997). *Barriers to Learning in Distance Education*, [Web page]. University of Southern Mississippi,. Available: <http://www.infrastructure.com/barriers.htm> [2001, Nov. 10].
- Giroux, Henry A. (Ed.) (1997). *Education and cultural studies: toward a performative practice*. New York : Routledge
- Grossberg, Lawrence; Nelson, Cary; and Treichler, Paula A. (Eds.) (1992). *Cultural studies*. New York : Routledge, 1992 p. 731-770
- Grossberg, Lawrence (1997). *Dancing in spite of myself : essays on popular culture*. Durham, NC : Duke University Press, 1997.
- Gudykunst, W. B. (1994). *Bridging differences: Effective intergroup communication* (2nd ed.). London, new Delhi: Thousand Oaks, Sage Publications.
- Handy, C. (1995). Trust and the virtual organization. *Harvard Business Review*, 73(3), 40-50.
- Harasim, L. M. *Online education : perspectives on a new environment*. New York: Praeger.
- Hofstede, G. H. (1997). *Cultures and organization: Software of the mind*. New York: McGraw-Hill.
- Johnson, D. W., Johnson, R. T., Smith, K. A. (1998). Cooperative learning returns to college - What evidence is there that it works? *Change*.
- McLoughlin, C. (1999). Culturally responsive technology use: developing an on-line community of learners. *British Journal of Educational Technology*, 30(3), 231-243.
- Marcus, George E. and Shannon, Patrick (Ed.) (1997). *Zeroing in on the year 2000: the final edition*. Chicago: University of Chicago Press.
- O'Hara-Devereaux, M., Johnsen, R. (1994). *Global work: Bridging distance, culture, and time*. San Francisco, CA: Jossey-Bass Publishers.
- Piaget, J. (1977). *The development of thought: Equilibration of cognitive structures*. New York: Viking Penguin Publications.
- Slavin, R. E. (1991). *Educational psychology : theory into practice*. Boston: Allyn and Bacon.
- Savery, J. R., Duffy, T.M. (1996). Problem-ased learning: An instructional model and its constructivist framework. In B. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design*. New Jersey: Englewood Cliffs, Educational Technology Publications.
- Schmuck, R. A., Schmuck, P.A. (1997). *Group Process in the classroom*.
- Thoreau, H. D. (1996). *Walden*. Hungary: Konemann Verlagsgesellschaft mbh.
- U.S. Department of Education, N. C. f. E. S. (1999). *Learning Resources and Technology*, [World Wide Web]. Digest of Education Statistics [2001, September 20].
- 21<sup>st</sup> Century Skills for 21<sup>st</sup> Century Jobs (1999). *A Report of the U. S. Department of Commerce*: U. S. Department of Education, U. S. Department of Labor, National Institute of Literacy, and the Small Business Administration.



# The Medium is the Message – The Design of an Online Collaborative Learning Community

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## Abstract

*This paper describes a constructivist and collaborative approach to transforming a traditional face-to-face on-campus course into an entirely Web-based course. The major objectives of this Computer-Supported Collaborative Learning (CSCL) course are for students to experience, learn and design online collaborative learning. This paper is based on the multiple experiences and perspectives of the course instructor, a course designer who also served as one of the moderators, and a student in the course. The purposes of this paper are to (1) describe the design, implementation, and evaluation strategies used in this Web-based collaborative learning course, (2) examine the characteristics of the authentic environment designed to enable students to experience the strategies, opportunities, challenges and benefits of online collaborative learning, (3) discuss the roles and benefits of using “e-sherpas” as a unique support system for online learning teams, (4) explore students’ perspectives, reflections, and suggestions, and (5) discuss course evaluation results, lessons learned, and implications for design of online collaborative learning environments.*

## Introduction

Just as companies are expanding their markets globally through the Internet, so are universities increasingly offering courses globally through the Internet. There has been rapid growth in the number of courses being offered either entirely online or as a supplement to a face-to-face course (Underwood et al., 2000; McLoughlin, 2000; Mugler & Landbeck, 2000; Graham & Scarborough, 1999). Online courses span a broad spectrum of pedagogical practices from highly controlled, linear, and teacher-centered online curriculum to situated and learner-centered curriculum. Most courses are driven by the functionality and availability of tools while others are inventing new tools or new approaches to meet the specifications of a particular curriculum structure and goals.

Many online courses simply transfer face-to-face classroom lecture-based content onto online platforms without considering interactive and human factors. Instructors who transfer lecture-based face-to-face instruction models to web-based environments, often tend to create online courses with little interactivity or opportunities for students to engage in discourse, collaboratively solve problems and construct their own knowledge. Although the value of collaborative learning is recognized, many instructors are unaware of the strategies and processes for building viable virtual learning teams. Instructors and instructional designers need to understand the nature of online interactions and communications, the dynamics of group collaboration, and strategies for facilitating online interactions among diverse learners in order to design effective web-based learning activities.

The paper examined the design and implementation of a Web-based collaborative learning course that was offered at the University of Texas at Austin in fall, 2000 from the perspectives of the course instructor, a member of the instructional design team who also participated in this course as an e-sherpa (e-moderator), and a student who completed the course. The paper describes the specific design features of the course and examines the effectiveness of the e-sherpa as a support system for virtual learning teams based on feedback from the students, instructor and the e-e-sherpas. It also discusses the lessons learned and the implications for design of online collaborative learning environments.

## The Course Context

A major goal of this CSCL 2000 course was to help learners understand, create, and reflect upon online collaborative learning. A variety of instructional material, resource links, and scaffolding guidelines were made available to learning teams via the WebCT courseware (Graph #1). The course content was divided into seven modules, a course handbook, a course tool page, and a resource link page (Graph #2). Each module contained tasks

in which learners had to work both individually and collaboratively to complete learning tasks. Collaborative tasks included writing a topic paper, designing a MOO (Multi-user Object Oriented) virtual environment where users log onto a site to experience a text-based virtual reality environment, designing a WebQuest, and working collaboratively with cross-team members to develop a final project utilizing a schedule planning tool for coordination.

Module One provided an overview of the course goals, objectives, required entry skills, technology requirements, course activity schedule, and other information helpful to the students in preparing to complete the course. Module Two provided opportunities for online socialization by introducing the mission of the course, the online environment and tools, and encouraging students to socialize with peers through a class-wide introduction activity. Module Three, Four, and Five required students to exchange information and construct knowledge through online communication, collaborative inquiry, dialogue and discussion, and team building. Modules helped students understand the unique aspects of online communication and collaboration and the need for respect, honesty and mutual support. Students worked collaboratively to navigate and explore various network environments, utilizing collaborative tools to plan, schedule, negotiate, develop, make decisions, and edit finished projects as a group. The course involved developing complex collaborative documents, WebQuests as well as other intellectual products designed to engage the students in a variety of online collaborative activities with a range of collaborative technologies. In addition to the content in each module, a course handbook was developed to provide information such as a virtual office tour, an organization chart about this virtual company, a staff directory which contained information about students in the course, tips on working collaboratively, topics for collaborative work, and project examples.

Graph # 1: Course Web Site



Graph # 2: Course Modules



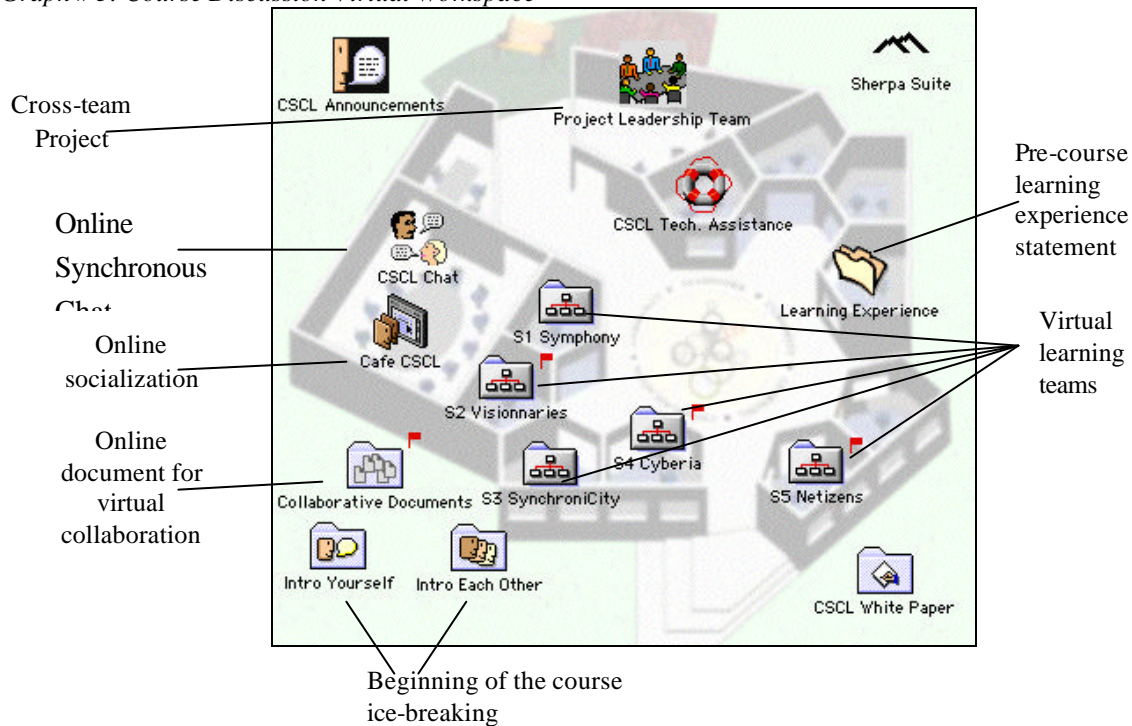
To accomplish course requirements, online socialization, collaboration, and communication were essential. Extensive cooperation and collaboration among learners was necessary. Web-based groupware tools offered students opportunities to exchange information, discuss tasks, upload files, work collaboratively on the same document, and socialize both asynchronously and synchronously (Graph #3). In order to provide an authentic environment, the metaphor of a high technology company, *CSCL Technology Corporation*, was employed to simulate a real world professional setting. Members of the class were divided into five virtual teams located in suites. There were two to three offices within each suite. Two to three students shared the same office and six to seven students shared the same suite (Graph #4). Diversity (ethnic background, gender, and on-campus or tele-campus access) was considered when assigning students into suites at the beginning of the semester.

Students in this CSCL course had to interact with peers, the instructor, and e-sherpas. The use of the e-sherpa is one of the key design features of this CSCL class. There was one e-sherpa in each suite of from 5-7 members. The term sherpa is used to describe a skilled Tibetan mountain climber on the southern slopes of Himalayas. The function of a sherpa on a mountain climbing expedition is to familiarize the expedition with the local terrain and to help members of the group carry their load. In this course, the e-sherpa was used to describe experienced online mentors who worked with online students in groups and helped them become self-directed and self-managed and to assist students with any challenges they encountered.

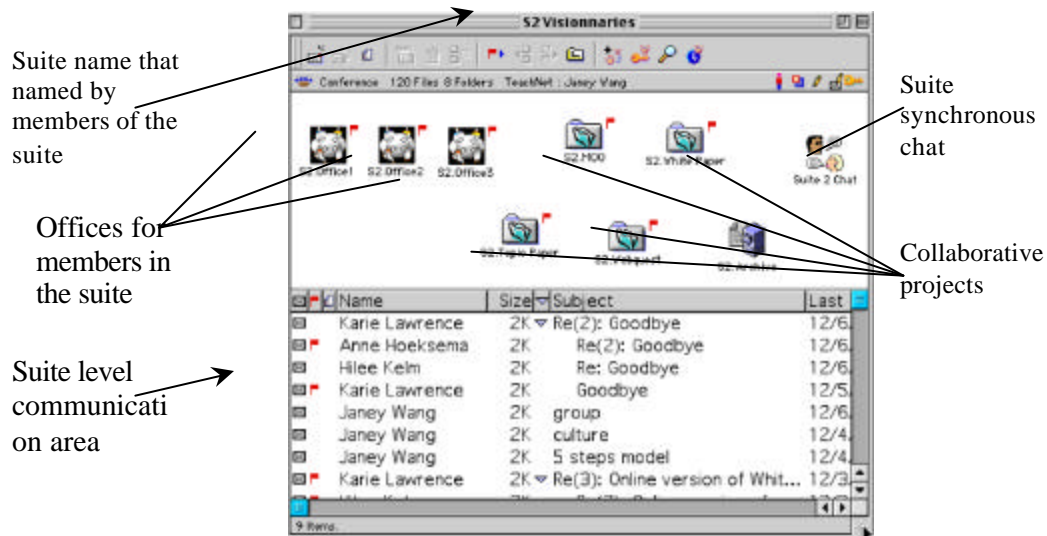
A monthly newsletter was provided at the course Web site. Students could obtain information about the regularly-scheduled Webcast (a video conference session where on-campus students can attend at the campus site and tele-campus students could attend through the Web). There were a total of five Webcast sessions in this

semester long course. During the Webcast, students could also participate through the dial-in phone conference from home or through the synchronous online class chat.

Graph # 3: Course Discussion Virtual Workspace



Graph # 4: Online Virtual Team - Offices and Suites



The intellectual products developed by the learning teams were based on the individual and collective contributions of members of the group. In accomplishing collaborative tasks such as creating the topic paper, navigating a MOO tour, producing a WebQuest, and writing a cross-team “White Paper.” With the assistance of various tools, learners not only learned how to exploit the functionality of the tool in working collaboratively, solving problems, making decisions, and producing products. Throughout the course, learners reflected on their learning at the end of each module through personal journaling.

To assess and improve students' performance and ensure learners are held accountable to each other, evaluation rubrics were used throughout the course. Rubrics are a type of scoring guide, used to assess more authentic and complex performances and products. According to Mary Rose (1999), rubrics provide “authentic

assessment” so the evaluations of student performance are “closer to the challenges of real life than isolated tests.” Rubrics that “communicate detailed explanations ... benefit students in making them more conscious about their own learning outcomes and process,” but also benefit instructors by providing them with an objective basis for assigning grades and involving students in the evaluation process.

### **The Medium is the Message**

Two of the major challenges in Web-based courses are faculty understanding the pedagogies for engaging learners in the online learning process and the heavy demands on the instructor to monitor and manage the course. Many distance-learning courses experience high attrition rates that result from a complex of factors such as learners feeling isolated, unmotivated, overwhelmed, or unchallenged in distance learning courses. This results in the 32 percent dropout rate for online courses as compared to 4 percent for regular classroom classes (Viers, Robert).

In addition, it is easy for faculty to get overwhelmed by the amount of work it requires in developing Web-based courses. This work involves developing the initial idea of the online course and re-conceptualizing the instructional practice in order to integrate technology into curriculum. It involves extensive work in designing and developing the course content and activities, and further, to implementing and evaluating the course so students feel motivated, satisfied, and engaged. The entire evolutionary process is very costly in terms of faculty and staff time in developing the course.

### **Course Design: Constructivist Theory for Authentic Environment Design and e-sherpas**

The philosophy behind the design of the CSCL course is Constructivism. Constructivism can be defined as a theory of learning in which knowledge is constructed in the mind of the learner. Jonassen (1994) identified the following elements of constructivist design: (1) multiple representations of reality, (2) representing the complexity of the real world, (3) emphasizing on knowledge construction instead of knowledge reproduction, (4) emphasizing authentic tasks in a meaningful context rather than abstract instruction out of context, (5) preferring real world settings to predetermined sequences of instruction, (6) encouraging thoughtful reflection on experience, (7) knowledge construction should be both content- and context-dependent, (8) knowledge construction should be through collaboration rather than competition among learners.

Reflecting Jonassen’s points on constructivist theory, various design features were employed in this CSCL course. As an example, a rich learning environment with multiple forms of representations were provided to allow learners with multiple intelligences to feel comfortable in the environment and to exhibit a broader range of their talents and expertise. The provision of an authentic environment is one of the major messages this course was intended to deliver. Both cognitive and social aspects of learning were emphasized in the course. Students worked in teams throughout the semester to complete tasks. Multiple perspectives were encouraged. Authentic tasks and activities, reflecting real-world settings, built in a coherent framework allowed learners to solve problems collaboratively and develop critical thinking skills.

Constructivist classrooms are different from traditional class settings. In this environment, students work in groups while individual contributions are highly valued. Activities require students’ contributions. Curricula data generated in the environment are based on dialogue and interactions among learners. The instructor, rather than a sage on the stage, seeks students’ points of views and facilitates student learning. The understandings obtained from students are used as references for on-going course revisions. The learners, rather than passive knowledge absorbers, are viewed as thinkers and active learners. The assessment of student learning is usually based on students’ work and progress throughout the process rather than paper-pencil tests predetermined by the instructor. The features of constructivist classrooms were deliberately built in the online CSCL curriculum.

Brooks and Brooks (1993) have identified characteristic teacher and student behaviors that are commonly found in constructivist classes: (1) encouraging student autonomy and initiative, (2) asking open-ended questions and allowing time for responses, (3) encouraging higher level thinking, (4) encouraging dialogues between the instructor and students and among students, (5) challenging students’ existing knowledge and encouraging discussions, (6) encouraging the use of raw data, primary sources, and manipulative and interactive materials.

The authentic environment in this Web-based CSCL course engaged students in thoughtful and collaborative activities. There were a variety of ways team members could communicate creatively and flexibly with each other and with the instructor. As an example, students collaborated to produce projects and make decisions in pairs, in small groups, and across groups. The asynchronous nature of communication allowed learners to have opportunity for reflection and revise their answers rather than reacting immediately. The authentic activities presented learners with various problems and engaged them in various forms of collaboration and cognitive

challenges. Further, multiple perspectives among diverse learners challenged learners' existing knowledge and encouraged them to actively participate in conversations in order to achieve group success.

The CSCL class involved learners in the cognitive process in three ways: (1) The course content involved learning how to use collaborative tools, (2) The course organization involved learning how to work collaboratively with others in complex learning tasks, (3) The course location involved learning how to work at a distance, synchronously as well as asynchronously.

For better course management and learner support, the concept of the "e-sherpa," coined by the instructor, Dr. Paul Resta, was employed to function similarly to the e-moderators described by Salmon (2000). Gilly Salmon used a few case studies to describe the e-moderators' role and responsibility. As an example, Quantas College Online (QCO), an online course established in 1996 for the purpose of training all staff within Quantas Airways, expected e-moderators to welcome and encourage participants, monitor learning progress, provide feedback, facilitate learning sessions, moderate discussions, provide input, assess learning outcomes, maintain records, and update status of participants.

In this Web-based CSCL course, an e-sherpa represents a non-authoritarian support person who climbs the mountain with students to help them accomplish their goals rather than directing and leading students. The role of the e-sherpa differs significantly from the traditional authoritative leadership figure. Much like real Tibetan sherpas, the e-sherpa in this course context is neither that of serving as the leader of the team nor as the authoritarian figure of the group. Their role was to simply accompany learners and to help the online team carry the load and accomplish its learning goals. In this course, e-sherpas were a group of graduate students who had prior knowledge of the similar course structure, experience in working in online teams, good communication skills, and who were interested in the online learning environment. Some of the e-sherpas were employed at the CSCL course instructor-directed computer lab while others participated on a volunteer basis online.

The e-sherpas' roles and responsibilities included unobtrusive approach to participating and supporting learners, assisting learners when they encounter technical difficulties, clarifying assignments when necessary, providing emotional support as needed, communicating and mediating conflict within the team, helping carry the load when emergencies arise, providing positive feedback and encouragement, monitoring learning progress and sharing with the instructor and fellow sherpas.

### **Students' Perspectives: Issues related to course design and implementation**

The design and implementation of the course required extensive monitoring, feedback and on-the-fly revision of any uncovered problems such as broken link. Course revision was an on-going process and was based on the analysis on progress in course by the instructor and instructional designers as well as understanding learners' perspectives, experiences, reflections, and suggestions. The following sections provide a summary of the feedback from students in end-of-semester course evaluations which were based on a 5-point scale measurement and issues, perspectives, experiences, and reflections discussed from the perspective of one of the authors, who was a student in the course.

#### **General Survey Results**

- I am very satisfied with the course: **3.95**
- I have learned a lot in the course: **4.29**
- I enjoyed the course: **4.05**
- The course was very stimulating for me: **4.33**
- My cooperative/ collaborative skills have improved: **4.33**
- I would like to participate in other online courses: **4.71**
- By participating in CSCL activities, I developed new perspectives on learning: **4.38**

#### **A Students' Reflections**

##### **1. Procedural issues**

The flexibility of the FirstClass groupware to provide e-mail, collaborative documents, chat, and individual and group folders made it an ideal tool for use in collaborative learning. The FirstClass collaborative environment was, however, new to most students, and the business metaphor of suites and offices was also unfamiliar and at times confusing. As part of course requirements, students were expected to locate or deposit reflections,

collaborative and individual project contributions, completed projects, introductory exercises, and work in progress documents in specific places within the virtual office. When students needed clarification to negotiate the complexities of the site, the sherpa was contacted and proved useful in clarifying these locations for the teams, especially at the beginning of the course.

In addition, the office metaphor was extended with the addition of a CSCL Announcements bulletin board icon, an icon for Tech Assistance, and a CSCL Cafe icon for informal comments unrelated to specific course concerns. The service provided by the Announcements feature was evident to all students, but the purposes of the Cafe and Tech Assistance services were sometimes misunderstood. On occasion the professor or the e-sherpa was sent questions that should have been directed to technical support, and the questions had to be forwarded to the proper technical support person. In the case of the Cafe, discussions posted there were sometimes course-specific and the class was reminded to exchange these comments in another location within their suite or office.

## **2. Third-party issues**

The CSCL course employed several collaborative tools. As already mentioned, First Class trouble-shooting questions were sometimes misdirected to other persons instead of to the technical support folder. In the case of the other collaborative tools, in particular the various MOOs, Zebu, and the WebQuest building site, there was no clear source of technical support and students often spent more time trying to negotiate the pitfalls of the sites than they did working on some of the assignments. Some students experienced frustration and the pressure of meeting deadlines as they struggled with these sites. Of necessity, students established informal networks of assistance in which solutions to common problems were shared. A FAQ icon within the office graphic or one or more e-sherpas with special expertise would have been of great assistance here as expert resources to consult about the sites and their potential problems so students could more quickly use the resources.

## **3. Assignment clarification**

Consistent with a constructivist philosophy the assignments were open-ended, varied, and not cumulative, and so each one had specific and unique features that the team members had to establish and clarify among themselves before and during their collaborative work. Students had to determine not only the specific content the assignment was requesting, but also the format it was to take, how it was to be organized, which parts were to be generated collectively, and which were to be generated individually and then collaboratively refined. They employed informal on-going formative evaluations as their work evolved and became more complex. There were project rubrics, which were ambiguous at times as assignment requirements were modified, as well as peer evaluation rubrics against which assessed students' contributions to the project. E-sherpas or the instructor were asked questions regarding the assignment components, and they responded with further explanations for teams or individuals.

## **4. Interpersonal issues**

Students were placed in learning teams to assure diversity and balance in culture, knowledge of the content, and technology expertise. Occasionally, conflicts among team members arose related to differing expectations with regard to work or to interpersonal interactions. In order to successfully complete assignments, it was important for group members to take responsibility for participation in group work sessions and to meet deadlines. Sometimes work issues related to differences in quality or quantity of work arose in teams. Individuals and the group as a whole were challenged to negotiate mutually satisfactory conventions that enabled cooperation, compromise, and the giving and receiving of constructive criticism. These skills were vital for the development of quality team products and projects as well as timely completion of the project. The course design provided for the rotation of leadership roles among team members.. This allowed each team to find its own way of working best while giving each individual an opportunity for carrying greater responsibility for a while.

It was additionally important for group morale for members to be understanding, supportive, and encouraging of the work of other team members. In a few instances, individuals were unable or unwilling to serve as emotional as well as intellectual partners with their team members. In those instances, the team had greater difficulty in accomplishing its learning tasks. For the team to be successful, it had to find ways to resolve all of these issues and reach consensus. Over the entire period of the course, a general ecology of support emerged with each member contributing from his/her strength as roles emerged for leading in a variety of ways. The e-sherpas were consulted

less and less and usually asked for help only when there was an impasse. At this stage, the problems were then addressed and resolved by the instructor.

## Suggestions

E-sherpas have the potential to serve several useful functions in developing and supporting online learning communities. The responsibilities, however, may require special knowledge or training in order for them to meet all of the challenges in helping virtual learning teams be successful.

1. Course assignments should be made as clear as possible, taking into consideration that in real world settings a considerable amount of ambiguity is inevitable. The e-sherpa must have a clear understanding of the course assignment components in order to clarify them to the team while avoiding offering editorial comments on the work products themselves. Obviously this responsibility requires that the e-sherpas be kept up to date on any changes to the course and its assignments that are made as the course progresses.
2. A source of practical information about the courses' collaborative tools would be an important element in the technical support network and would fill a need not met by the courseware technical support staff. Team members could avoid frustration and lost time if they could consult a FAQ or e-sherpa with the ability to facilitate their use of the collaborative tools.
3. For many students new to online collaborative learning, some direct instruction or required reading about forming collaborative teams might ease their transition from the tradition of individuals working competitively to teams working collaboratively in a constructivist classroom. An e-sherpa with skills in mediating collaborative working interactions would be useful early in the course to assist the learning team in working through the awkward period of establishing individual identities within the group ecology. Such assistance might forestall the need for more critical guidance later by establishing a well-functioning team from the start. If difficulties arose later, a working relationship with a trusted and skilled e-sherpa might make resolution of the problems easier.
4. Much of what the teams devoted themselves to might more correctly be thought of as collaborative work rather than collaborative learning although all boundaries between the two are often unclear. Through guiding conversations throughout the course, an instructor or e-sherpa could provide a way for team members to become aware of how the course is structured to facilitate collaborative learning, consider what other collaborative strategies they might try, and examine the features of effective communication within a collaborative endeavour. Difficult decisions would need to be made to prioritise existing course goals, content, and activities to build in the time and opportunity for these interactions with team members to take place.
5. Feedback in the course for team projects as well as for individual contributions and reflections was relatively sparse. One feature of constructivist theory is time for reflection on the learning process. While academic feedback is the provenance of the instructor, if the e-sherpas were deeply engaged in observing the interactions within a team, he/she would be uniquely situated to give astute feedback to the team on the nature of its collaborative interactions and to draw members into conversation about what they were learning. Using the e-sherpa merely to convey observations on the workings of the learning teams and their academic products is useful but does not capitalize on the full potential of the e-sherpa in supporting the learning of the members of the learning community.
6. At its best collaborative learning can produce a learning experience and artifacts of that experience that are greater than what an individual student could achieve working alone. The time and opportunity for risk-taking are essential for reaching this higher level of achievement. In this particular course risk-taking on the part of individuals or teams was thwarted in a number of ways. The time allowed for assignment completion did not provide a cushion for false starts or revamping common in risk-taking situations. Fewer assignments or more relaxed time requirements might alleviate this problem. Instructor feedback and its associated reassurance and encouragement are also an intangible support for risk-taking attitudes among students. The course needs a faculty presence through feedback communication with teams and with individuals more frequently and more specifically to encourage students to test their potential. Finally, the frequent peer assessment feature of the course discouraged vigorous debate or discussion that might have resulted in the group undertaking a project that contained more risk.

Team members were cautious in order not to be misunderstood and evaluated as uncooperative or unsupportive of the group.

To assure individual accountability, team members assessed their own contributions as well as those of all other team members at the end of each learning module. The positive aspect of the peer evaluations was that it helped individual team members who were late in contributing their work or participating minimally in collaborative task to become more active members of the learning team. It is also possible that the frequent peer assessments discouraged vigorous debate or discussion that might have resulted in the group undertaking a project that contained more risk. There was evidence that some team members were cautious in order not to be misunderstood and evaluated as uncooperative or unsupportive of the group.

### **Lesson Learned and Future Implications**

Many instructors believe that online learning can have a very bright future if courses are designed well. Yet, merely transferring existing curriculum online and grouping students without regard to interpersonal dynamics will not achieve ideal student participation and collaboration. Instructors and instructional designers need to truly understand the nature of online interactions and communications, the dynamics of group collaboration, and strategies for facilitating online interactions among diverse learners in order to design activities for effective interactions.

Students and e-sherpas made various design and implementation suggestions at the end of the semester. Some of these suggestions included:

- Building trust by providing ice-breaking sessions at the beginning of the semester
- Providing e-sherpas' training prior to the semester
- Clarifying e-sherpas' roles and responsibilities prior to the semester
- Standardizing e-sherpas' monitoring process of learning teams' progress
- Standardizing e-sherpas' observation and report guidelines
- Specifying assignments and providing immediate clarifications of students' questions
- Linking design goals and implementation processes seamlessly
- Valuing the social aspects of learning equally to cognitive aspects
- Clarifying leadership roles by providing explicit guidelines
- Considering the number of tools employed carefully to avoid overwhelming students
- Avoiding holiday assignment deadlines by examining the course schedule
- Employing tasks as building blocks toward students' final projects
- Improving the immediacy of feedback for technical and instruction-related questions
- Providing frequent and constructive instructor feedback on students' learning progress
- Assisting students by conducting virtual office hours regularly
- Providing self-check quizzes in assisting learners in tracking their learning progress
- Surveying and identifying students' concerns and suggestions regularly
- Adjusting/revising course based upon identifying student concerns and suggestions

As one of the pioneers in online collaborative learning course design, we still have much to learn about the design, implementation, and evaluation to achieve optimal results in Web-based learning. The dropout rate of this CSCL course, however, was only two out of 32 students in class and the overall course evaluations were very high.. We understand that technology tools can only provide high quality in the hands of good teachers. Through the sharing of our experiences, good practices, perspectives, reflections, and suggestions, we hope to enhance online instruction in higher education.

### **References:**

- Brooks, J. G. a. B., Martin G. (1993). *In Search of Understanding: The Case for Constructivist Classrooms*. SEDL (Southwest Educational Development Laboratory). Available: <http://www.sedl.org/scimath/compass/v01n03/1.html> [2001, June 20].
- Graham, M., Scarborough, Helen. (1999). Computer mediated communication & collaborative learning in the undergraduate distance education environment. *Australian Journal of Educational Technology*, 15(1), 20-46.



- Jonassen, D. *Constructivism*, [World Wide Web]. Available: <http://www.coe.uh.edu/~ichen/ebook/ET-IT/constr.htm> [2001, June 29].
- McLoughlin, C. (2000). Designing learning environments for cultural inclusivity: A case study of indigenous online learning at tertiary level. *Australian Journal of Educational Technology*, 16(1), 58-72.
- Mugler, F., Landbeck, R. (2000). Learning, memorization, and understanding among distance learners in the South Pacific. *Learning & Instruction*, 10, 179-202.
- Rose, M. (1999). *Make room for rubrics* (Vol. 108). New York: Bell & Howell Information Service.
- Salmon, G. (2000). *E-moderating: The key to teaching and learning online*. London, UK: Kogan Page Limited.
- Underwood, J., Underwood, G., Wood, David. (2000). When does gender matter? - Interactions during computer based problem solving. *Learning & Instruction*, 10, 447-462.
- Viers, R. *Examining online courses*. Netweek Online Journal. Available: <http://www.ed2go.com/news/onlinecourse.html> [2001, November 10].

# Simple Techniques for Using the Internet as a Supplemental Course Resource

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## Abstract

*With the wide acceptance of the Internet as an information and communications source, students have come to expect it to supply supplemental course material and other enhancements to their traditional classroom activities. Students have grown accustomed to the 'anytime / anywhere' capability and flexibility offered by the World Wide Web. This media will become a vital exchange mechanism between educators and students. However, the technologies that support the Web are very different from those traditionally used in the preparation and delivery of course content. This can make entry into the Internet course support arena a challenge for educators not familiar with its inner workings.*

*The same Internet acceptance and usage expectation that is forcing educators into the World Wide Web has also provided us with some simple tools and techniques that can be employed to begin the integration of the Web into course support. The Web has become so integrated into all aspects of computer usage that most personal productivity applications provide Web tools as part of the software. The degree of this integration varies with the application and the vendor, but these rudimentary Internet tools exist in much of the software educators use in course preparation and delivery. Through the application of these simple tools to the documents, spreadsheets, communications, and presentation currently generated, they can easily be made available to students through a Web page. Lecture notes, presentation slides, study guides, practice quizzes, solutions, and homework guides are just a few of the documents educators generate with a word processor. These can easily be converted to a format that is viewable over the Web. Grade postings and other data generated with a spreadsheet can be made available via the Web in a similar manner.*

*The on-demand availability of the Internet offers several advantages. Students can access information when they are ready to study, not when the instructor is available to present it. Students can access the specific information needed to finish a specific assignment. As a result of this information availability, the instructor will spend less time redistributing lost or missed information, and less time answering the same question from several different students.*

*On-demand information availability is beneficial to both traditional and non-traditional learners. Traditional students maintain the structure and control of traditional instructional methodologies while having increased access to support information. Non-traditional students are provided a mechanism that places them personally in control of what they learn, and when they learn it. This control is a necessary component of successful learning in the non-traditional student population.*

*The Internet offers the student more timely access to specific course-related information with less effort on the part of the instructor. Add in the wide acceptance and availability of the Web, and new opportunities for course and learning improvement become evident. With minimal effort, the Internet can enhance almost any course.*

## Introduction

The Internet is a widely accessible, on-demand source of information. Students have come to rely on the Internet for most of their information gathering activities. They go to the Internet for information on anything from the configuration of a networking cable to the show times at the local movie theater. Three fourths of all college seniors use the Internet in their job search. (Shelly 2000) Given this wide acceptance, it is reasonable to assume that students will also look to the Internet for course related materials such as lecture notes, assignments, grade postings, and even general communications.

Many institutions have a Web presence that is maintained by the institution. Frequently, the homepage of the institution's website will have links to individual department pages. These departmental pages will in turn have links to individual course pages. The institution will often provide a page for each course based on a common template that is used for all courses institution-wide. This common template often includes standard links to common course page content such as grades and class notes. The faculty associated with a specific course are usually given access privileges to the folders that contain the Web pages for that course, thus allowing them to create and maintain course related Web content.

The Web presence for the course is in place. However, course information is available on the World Wide Web only if the course instructor makes it available. The tools and technologies that have traditionally been used to create World Wide Web content are different from those used to create normal course materials. Learning these new tools requires an investment of time that many faculty cannot justify. For this reason, many faculty do not support their courses on the Web even though a Web presence is already available.

The same wide acceptance of the Web as the de facto information source has encouraged many software developers to include Web support features in applications that have not traditionally been associated with Web content development. Currently, many of the applications that have traditionally been used in course material development include basic Web content development features. Personal productivity tools like word processors, spreadsheets, and presentation software now provide simple tools to generate Web content. With a basic understanding of the organization of a Web page, browser operation, and the tools available in current personal productivity software, most faculty can develop Web content to support their courses.

## Web Page Organization

The World Wide Web is actually a wide area network of over 4 million loosely connected servers that provide information upon request. (Goldman 1997) These servers hold the files that create Web pages. When the server receives a request to view a Web page, the server downloads the files needed to create the page to the requesting computer.

Each Web server is identified by a unique name called a URL, short for Uniform Resource Locator. A URL consists of protocol specification, a domain name, and optional path to a specific Web page. URLs are specified using the familiar format **http://www.domain.com/path/page.htm**.<sup>2</sup> In this example the protocol is **http**, which stands for hypertext transfer protocol. Hypertext transfer protocol is the communications standard (protocol) for transferring Web pages. The domain is represented by **www.domain.com**, and **/path/page.htm** illustrates the format for the optional page reference. In an actual Web page reference, the domain (**www.domain.com**) and the optional page specification (**/path/page.htm**) would be replaced with the domain name of the Website being accessed and the (optional) path and file name of the desired page.

Each domain must be registered with an organization that is responsible for assigning maintaining domain information. Each domain is associated with a specific location on the World Wide Web called its Web address. These addresses are composed of four three-digit numbers separated by periods (i.e. 230.195.013.212). (Goldman 2001) Domain information is kept in databases at specific locations accessible to the World Wide Web. When a user requests to view a website, browser software on the user's computer references the databases to determine the Web address of the website in question. A request is sent to the Web server at the address obtained from the domain database. The Web server at that address equates the domain to a specific folder located on the server. It locates a file in the designated folder titled INDEX.HTM and sends that file to the requesting computer. This file represents the homepage for that website. The Web homepage may be titled HOME.HTM on some system.<sup>2</sup>

Additional pages in the website are usually arranged in folders that are subordinate to the folder that contains the homepage. The folder system is used to organize additional pages that are referenced through the home page in the same way that folders are used to organize files on a drive. System administrators frequently use this type of folder arrangement to allow certain users access to certain areas of the website, without giving all users access to all pages of the website. Ideally, the instructors are given access to folders that contain information relevant to the courses they teach. This access allows the appropriate faculty to post course materials to the website.

The Web presence may be maintained internally, or it may be outsourced. If maintained in-house, the Web files frequently reside on a server within the institution. If the folders that contain the website files are accessible through the institution's network, it is possible to add content to the website directly, provided the user has been granted access privileges to the necessary folders. If access privileges are not available to the course instructors or if the website is maintained off-site, the institution will designate a specific individual, sometimes call the Webmaster, to post all files to Web folders. This is done to ensure that all postings adhere to institutional policies for Web content, and to maintain security. If the institution allows only the Webmaster to access the system, then all postings to the Web must be forwarded to the Web Master. The institution should have a mechanism in place to handle posting requests.

The URL will allow a browser to find a specific server on the Web. By including the file and path in the URL any file within that Web server can be accessed, even if there are no links from existing Web pages to that file. Faculty can place information on the Web, by either directly accessing the Web folders or by requesting postings from a Webmaster. Once the file is posted in the website, students can be given the complete URL to the file.

Students can access the file by entering the URL, complete with the path and file, into the browser. Links from other Web pages are not needed.

For example, let us place the syllabus for a course numbered CPT250 on the Web. The original syllabus is saved under the name **Syl250Fall01.htm** in the **My Documents** folder on the local C:/ drive. The Web site domain is **pua.edu**. The files used to generate this website are located on a network drive designated **W:/**. The CPT250 Web page is located in the **/courses/cpt/cpt250/** folder. Since a folder already exists for CPT250, we will place the syllabus in it. You Webmaster should be able to provide information on the folder layout for your Web site. Begin by moving the syllabus in the Web folder. Use Windows Explorer to copy the file **Syl250Fall01.htm** from the **My Documents** folder on the **C:/** drive to the **/courses/cpt/cpt250/** folder on the **W:\** drive. The last step is to provide students with the complete URL of the page, **http://www.pua.edu/courses/cpt/cpt250/Syl250Fall01.htm**. Students can access the syllabus by entering this URL into a browser.

Many institutions provide a common template for course Web pages. The common template promotes a consistent look and feel to the Website, and also helps keep individual course pages consistent with Web policies. The Webmaster creates a Web page for each course from the template. Links are provided to the individual course pages from the home page. The template often contains links to such common components as grades, syllabi, and class notes. Exploiting these available links will ease student access to the information.

The key to using a predefined link from an existing page is knowing what the link accesses. Links are actually instructions to the browser to retrieve and display another Web page. Recall that Web pages are contained in files. Thus, a link contains the name of the file to be accessed. When a file of that name is placed in the appropriate folder, the link will retrieve and display the information from that file. Predefined links can be used only if the file name and path of the file the link accesses are known. The Webmaster should be able to provide this information or post files to the proper locations for you if access is restricted.

The file name is defined in the link when the Web page is created and is not easily changed. However, it is easy to change the name of a file. Changing the name of a file to match that specified in the link will cause the browser to display the information in that file. As an example, let us assume that a faculty member has a syllabus for CPT250 that needs to be posted to the CPT250 Web page. The original syllabus is saved under the name **Syl250Fall01.htm** in the **My Documents** folder on the local C:/ drive. The institution's Web site has a page for CPT250 with a Syllabus link that displays a file called **Syllabus.htm**. The website domain is **pua.edu**. The files needed to generate the website are located on a network drive designated **W:/**. The CPT250 Web page is located in the **/courses/cpt/cpt250/** folder. Again, we will place the document there. First, rename the **Syl250Fall01.htm** file to **Syllabus.htm**, the name of the file the Syllabus link will access. Next, copy the file into **W:/courses/cpt/cpt250/**, the folder the link accesses. Use Windows Explorer to complete the rename and copy operations. If a file named **Syllabus.htm** already exists in the **/courses/cpt/cpt250** folder you will be prompted to replace it. Once the file has been successfully copied into the **/courses/cpt/cpt250** folder, clicking the Syllabus link will retrieve and display the syllabus.

## The Browser

The browser is the application that allows a user to view information downloaded from Web servers. (Walters 2001) The user enters the URL of the website to be viewed. The browser locates the Web address from the domain database and sends a request to the appropriate Web server. The Web server downloads the requested files to the browser and the browser generates and displays the web page. The user must enter the exact URL in order for the browser to find the desired Web server.

Browsers use the data contained in the downloaded files to generate the Web page. This data must be presented to the browser in a format the browser understands. If the browser cannot understand the data presented, it cannot generate a Web page from it. The most common file format for generating text in a Web page is the HTML format. Hyper Text Markup Language is a formalized set of rules for specifying how text will be displayed. HTML adds additional information (called tags) to the text that instructs the browser on how the text should be displayed. As the text is downloaded, the tags are interpreted and the text is displayed accordingly.

Browsers can also display images in a Web page. Again, the data used to generate the image must be presented to the browser in a format that it understands. Most browsers understand many graphical formats. Some of the more frequently encountered graphical file formats are GIF, JPG, and PNC. Browsers can also generate audio from files using the WAV or MIDI format, and full motion video from A VI, MOV, and MPG formatted files. (Cadenhead 1999)

The browser can also provide limited access to files that are not in a format that it can understand. When the browser is asked to access a file in a type it does not recognize, it will offer the user the option of opening the

file or saving it to a local drive. If the user opts to open the file, the browser will hand the task over to the local operating system. The operating system will check the file extension to determine if it is a file associated with a specific application on the computer. If a corresponding application is found, then the operating system will start that application and open the file in it. If the operating system does not find an application that it associates with the file extension, it will open a dialog box and ask the user to select the application to use to access the file. If the save option is selected instead of the open option, the operating system starts a download wizard that allows the user to select a location and name on a local drive where the file will be saved.

### **Generating Web Content: Common Personal Productivity Tools**

The wide acceptance and use of the World Wide Web has affected much of the personal productivity software currently available. Many of the tools faculty currently use to generate course materials now have provisions for saving data in formats that browsers can understand. Word processors, spreadsheets, database, and presentation software now allow users to save documents in HTML format. Existing documents can be re-saved in HTML format, allowing creation of Web materials without additional work in a separate software tool. Once in HTML format, these files can be made available to students by placing them on the website. Students can, in turn, access the files through links in existing Web pages, or by entering the path and file name in the URL. All this is possible with a minimum of additional effort, using software the user is already familiar with. The keys to success are: 1) saving the documents in a format browsers understand and 2) placing these documents in the website where a browser can find them.

#### **Saving in HTML: A Microsoft Word Example**

Microsoft's word processor, Word, will save documents in HTML format. The following example uses the technique described above to save an existing homework assignment document in HTML format and place it on the Web for student access. The document is currently saved in a file called **Homework10.doc** and is located in the **My Documents** folder on the local computer. The new HTML version of the assignment will be saved in the webpage **pua.edu** in the **/courses/cpt/cpt250** folder. The Website home folder is designated as the **W:/** network drive on the local computer.

Begin by retrieving the original document into Word. Once the document is retrieved, save it in HTML format by clicking the *File* menu, and then clicking the *Save as Web Page...* option in the dropdown list. A new *Save As* window appears. Note the *Save In:* dropdown list in the upper left corner of the *Save As* window. Clicking the down arrow to the right of the input box will produce a list of all available drives. Navigate through this list and double click the **W:/** drive. A folder list will appear below the **W:/** drive icon. Next double click the **/courses** folder. Double click the **/cpt** folder in the list that appears. Double click the **/cpt250** folder in the folder list that appears below the **/cpt** folder. This will select the **/courses/cpt/cpt250** folder to receive the HTML file. Enter the name of the new HTML version of the document by typing the new name, **HomeWork10**, in the *File Name:* input box in the lower center of the *Save As* window. Do not add the **.htm** extension. The system will automatically append the appropriate extension when it saves the document. Finally click the *Save* button in the lower right corner of the *Save As* window. The HTML version of the homework assignment is now saved. Since the file was saved in a folder that is part of the Website, students are able to access the homework assignment on the Web by typing **http://pua.edu/courses/cpt/cpt250/HomeWork10.htm** in their browser's URL input box, or by clicking on a link to the file if one exists.

If direct access to the Web folders is not possible, the Webmaster will post the file to the website. First, save the Word document in HTML format per the example above but specify a local drive instead of the Web folder. Next send a request to the Webmaster to post the file to the Web. If the file will be accessed through the URL, the Webmaster should provide the complete URL after the posting is complete. If the file is to be accessed via an existing link, the Webmaster can place and name the file so the link operates properly.

#### **Saving in HTML: A Microsoft Excel Example**

Microsoft Excel, a popular spreadsheet application, will also save in HTML format. It is a common practice to post grades in a public place so students can monitor their status. This example illustrates how the Web can be used to post grades for student review by saving an existing grade spreadsheet in HTML format and placing it on the Web where students can access it. The grade spreadsheet is currently saved in a file named **GSP250F01.xls**. It is located in the **My Documents** folder on the local computer. The new HTML version of the

grade posting will be saved with the name **grades.htm**, in the **/courses/cpt/cpt250/** folder of the website **pua.edu**, designated as the **W:/** network drive on the local computer.

The first task is to retrieve the spreadsheet and save it in HTML format. Start Excel and open the **GSP250F01.xls** spreadsheet. Next, save the spreadsheet in HTML format by selecting the *File* option from the menu bar, and clicking the *Save as Web Page...* option in the dropdown list. The *Save As* window appears. Locate the *Save In:* input box and use the down arrow to the right to display the list of available drives and folders. Navigate through this list until the **W:/courses/cpt/cpt250** folder is located and double click that folder. Below the *Save In:* input box is a *Save:* section. This consists of two option buttons labeled *Entire Workbook* and *Selection Sheet*. Click the *Entire Workbook* option. In the *File Name:* input box enter the file name **grades**. Do not include the **.htm** file extension. Excel will append the extension onto the file name when the file is saved. Verify that the *Save as Type:* input box contains **Web Page**. If not, open the list by clicking the down arrow to the right of the input box and select the **Web Page** option. Finally, click the *Save* button. The grade posting spreadsheet will be saved as **W:/courses/cpt/cpt250/grades.htm**. Students can access the grades on the Web by entering **http://www.pua.edu/courses/cpt/cpt250/grades.htm** (the complete URL) into the browser. Clicking a link, if one exists, can also access the grades.

If direct access to the Web folders is not possible, the Webmaster will post the file to the website. First, save the Excel spreadsheet in HTML format per the example above but specify a local drive instead of the Web folder. Next send a request to the Webmaster to post the file to the Web. If the file will be accessed through the URL, the Webmaster should provide the complete URL after the posting is complete. If the file is to be accessed via an existing link, the Webmaster can place and name the file so the link operates properly.

### Generating Web Content: Downloads

The Web can also be used to make non-viewable files available. The browser cannot display the content of these types of files because they are saved in a format that the browser cannot understand. If the browser does not understand the format of a file, it will offer the user the option of opening the file using another application or downloading and saving the file to a local drive.

If the *Open* option is selected, the local system will check for an application that understands the format of the file. If the system finds an application that understands the format, the file can be opened and manipulated just as any other local file, with one exception. The local application cannot save the file back to the Web site. It must be saved on a local drive. If the system cannot find an application that understands the file format, it will present a list of all application available on the system and allow the user to select the application to use.

If the *Save* option is selected, the user is prompted to enter the location the file will be saved to. The user selects the desired location and initiates the download. The file is copied from the website to the local machine.

### Downloading and Opening a Word Document: A Microsoft Word Example

This example illustrates opening a Microsoft Word document file from a website. The file is in Word's **.doc** format, which is not understood by the browser. We assume that the student has Microsoft Word available on the local computer. The Web file is a Word document named **Homework10.doc**. It is saved on the Web site **pua.edu** in the folder **/courses/cpt/cpt250/**. To access the file click on an existing link or enter the complete URL and path into the browser: **http://www.pua.edu/courses/cpt/cpt250/homework10.doc**. A Windows Wizard will open offering option buttons for *Open this file from its current location* or *Save this file to disk*. Select the *Open* option button. The local computer will search for an application that understands files in the **.doc** format. It identifies Microsoft Word as an application that understands **.doc** files, starts Word running on the local computer, and downloads **Homework10.doc** into Word. The document can now be manipulated with Word just as any other local document. It can be saved to a local drive using the normal save procedure in Word, but it cannot be saved to the Web site.

### Downloading and Saving a Data File

The following example shows how to download a data file from a website. The file we want to transfer to the local computer is a data file to be used in a C++ programming assignment. The file name on the website is **InputData.dat**. The **.dat** extension indicates that this file contains data. Files with the **.dat** extension are not usually associated with any specific application and therefore cannot be opened from the website. The file is located on the **pua.edu** website in the folder **/courses/cpt/cpt250**. The goal is to change the file's name to **Proj3Input.dat**

and save it in the **Documents** folder of the local **C:/** drive. Begin by starting the browser and entering the complete URL and path of the file: **http://www.pua.edu/courses/cpt/cpt250/InputData.dat**. The browser will start the *File Download* wizard. The first screen offers the user two option buttons; *Open this file from its current location* and *Save this file to disk*. Select the *Save this file to disk* option. The next screen is the *Save As* dialog box. Click the down arrow to the right of the *Save In:* input box and double click the **C:/** drive. A list of all folders available on the **C:/** drive will appear. Double click on the **Documents** folder. The folder will open, and its contents will be displayed in the window. Type **Proj3Input.dat** in the *File name* input box and click the *Save* button. As the download begins, the wizard will display a status screen that shows the file source and destination information, the estimated time to complete the download, and the data transfer rate. When the download is complete, the screen will show statistics on the download process. The file is now in the folder **C:/Documents/**, under the name **Proj3Input.dat**. Verify this by opening Windows Explorer and viewing the contents of the **C:/Documents** folder.

## Conclusion

The Web is an information source that offers many faculty – student communications opportunities. Both faculty and students can benefit from the on-demand information availability the Web offers. The Web support features included in today’s personal productivity software will allow faculty to develop basic Web content with little or no additional effort. These features, used in conjunction with the existing Web presence of most institutions provides a framework on which faculty can grow course support with little or no Web development experience. This places Web course support within reach of most faculty.

## References

- Goldman, James E. (1997). *Local Area Networks: A Client Server Approach*. New York: John Wiley & Sons.
- Shelly, Gary B., Cashman, Thomas J., & Vermaat, Misty E. (2000). *Microsoft Office 200: Introductory Concepts and Techniques* (enhanced ed.). Boston, MA: Course Technologies.
- Goldman, James E., & Rawles, Phillip T. (2001). *Applied Data Communications: A Business Oriented Approach* (3<sup>rd</sup>. ed.). New York: John Wiley & Sons.
- Walters, E. Garrison. (2001). *The Essential Guide to Computing*. Upper Saddle River, NJ: Prentice-Hall.
- Cadenhead, Rogers. (1999). *Teach Yourself Microsoft FrontPage 2000 in 24 Hours*. Indianapolis, IN: Sams.

# Designing and Developing Rubrics As An Instrument to Assess ISTE's (International Society for Technology in Education) National Educational Technology Standards for Teachers (NETS-T)

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## Abstract

*Last year, the International Society for Technology in Education (ISTE) worked to develop and improve teacher skills in the area of educational technology by creating technology performance profiles for teacher preparation. These standards were given to a group of PSU instructional systems graduate students who developed rubrics to assess the four categories of standards. The process and methods used in the design, development, and creation of these rubrics will be presented and discussed, and the rubrics will be available for use by the participants.*

## Introduction

Assessment has always been an important part of both the education and training fields. Standards are also valuable way of defining expectations, but when it comes to assessing whether standards have been achieved the plot thickens. Issues that arise concerning the reliability and validity of measurement and assessment will always be present. Assessment instruments are not always easy to design or develop. Some assessment instruments such as rubrics can be of some help. Rubrics are designed to “focus on measuring a stated objective (performance, behavior, or quality), use a range to rate performance, and contain specific performance characteristics arranged in levels indicating the degree to which a standard has been met.” (Pickett) A rubric may be applied in many situations and score criteria that is, “summative, by providing information about a student's knowledge, formative, by providing information about a student's strengths and weaknesses, evaluative, by providing ways to create instruction that better fits each student's needs, and educative, by providing students with an understanding of how they learn.” (Luft, 1997) Rubrics evaluate and measure a learning situation using a holistic or analytical approach that ideally results in the creation of an easy to use matrix of learning targets and the level at which these targets are achieved. The number of categories and levels of mastery is always up to the creator(s) of the rubric.

This presentation discussed the use of rubrics as an instrument to assess standards. The National Educational Technology Standards (NETS) project writing team has created and defined technology performance profiles for teacher preparation across four categories in hopes to use these profiles in the development and improvement of teacher skills and competencies in the area of educational technology ([http://cnets.iste.org/pdf/nets\\_brochure.pdf](http://cnets.iste.org/pdf/nets_brochure.pdf)). This project, initiated by the International Society for Technology in Education (ISTE), focused on the development of national standards for various uses of technologies that are associated with school improvement in the United States. A group of graduate students at Penn State University, taking a class based on analyzing outcomes and learners, given these standards and charged with developing assessment instruments based on the ISTE standards. This presentation explored the design and development of those assessment instruments.

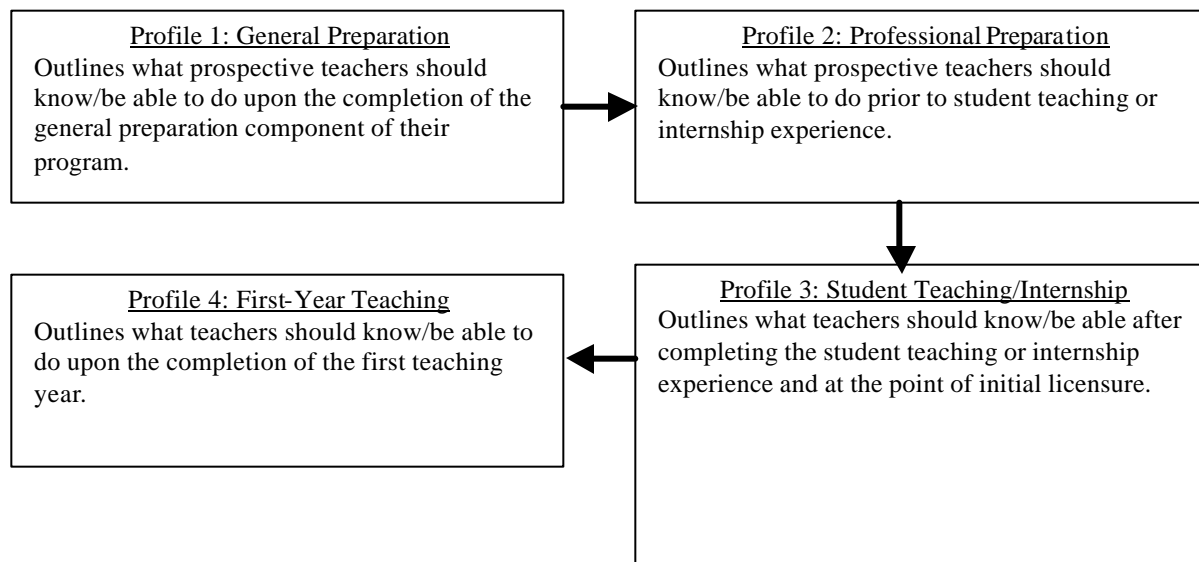
The presentation began with a brief introduction and statement of objectives. We then explored the work done by the ISTE NETS writing team with the intent to engage the audience in the specific areas addressed by these standards. We then explored the four categories of standards, general preparation, professional education, student teaching/internship, and first-year teaching and the suggestions for evaluation provided by a class well versed in analyzing learners and outcomes. We looked at separate rubrics the class constructed and examined how they relate to the original standards. We discussed the design and development of these rubrics and the processes, obstacles, and methodologies in which these assessment instruments were created. The presentation ended with an open forum and a brief question and answer period between the audience and the presenters.



The format of this presentation recommends a refined approach, used for creating and implementing rubrics, as an appropriate instrument of assessment, specifically when evaluating performance based on the ISTE's National Educational Technology Standards. The audience was expected to offer constructive criticism and suggested ways to improve upon the processes and methods used.

### *The NETS-T Project*

- The National Educational Technology Standards for Teachers (NETS-T) is an International Society for Technology in Education (ISTE) initiative, which seeks to prepare today's teachers -in-training to provide technology-supported learning opportunities and interventions for K-12 classrooms.
- This initiative is funded by a United States Department of Education's Preparing Tomorrow's Teachers to use Technology (PT<sup>3</sup>) Grant, a catalyst program designed to train technology literate teachers.
- Accordingly, NETS-T defines technology knowledge and skills, as well as attitudes new teachers should possess as they proceed through their teacher preparation programs.
- Each performance standard outlined in each of the four profiles is designed to assess ISTE's National Education Technology Standards (NETS) and their corresponding Performance Indicators for teachers.
- To facilitate this process, ISTE developed four profiles of technology literate teachers, each of which details the required technology knowledge and skills at the following stages of preparation:
  - Completion of the general preparation
  - Prior to internship/student teaching experience
  - After completion of internship/student teaching
  - Upon completion of first year



\*Additional details for each profile are available at [http://cnets.iste.org/pdf/nets\\_brochure.pdf](http://cnets.iste.org/pdf/nets_brochure.pdf) and at the ISTE website <http://www.iste.org>.

#### **Why We Did It**

- Kyle Peck, Ph.D., Professor of Education in Instructional Systems, assigned the assessment of the NETS-T, in partial fulfillment of a required graduate course in assessments.

- He felt that this project would both provide a real-life opportunity as well as be of practical value to ISTE's efforts, which, to that date, had not created a comprehensive assessment strategy for this initiative.

### How It Was Done

- For the most part, students were able to choose the Profile that they wished to develop assessments for.
- We were given the freedom to organize the performance standards such that it was deemed manageable.
- This meant combining, re-writing, and even removing performance standards that did not fit in with the respective graduate students assessment plan.
- Accordingly, it is safe to say that no two-assessment products within each profile were the same.

### Examples

#### Profile #2: Professional Preparation

#### Description

#### Learning Target III: Teaching, Learning and Curriculum (ISTE NETS Performance Indicators: I, III, IV,V)

Performance Objective: *The teacher will be able to design lessons and peer teach with technology that meets the content standards and reflects the best practices in teaching and learning.*

*Performance Standard:* Having observed teaching practices in various schools, video demonstrations and other peer teaching, the teacher will be able to design and teach lessons that reflect the best practices in teaching and learning using technology

*Assessment Method:* Lesson Plans and Teaching Practice

*Performance Task:* Design and teach technology enriched learning activities that maximize student leaning with diverse needs.

#### Learning Target I

#### Elements of Assessment: Knowledge of Technology Concepts, Tools and their Uses.

This is a 'to do activity' for your professional development.  
There are three sections numbered A, B, C. Please follow the instructions carefully.

#### A. Technology Concepts.

##### i) Assessing your conceptualization of technology-related concepts.

Directions: Work through this activity and construct your own personal concepts about technology. Circle T or F to indicate what is True or False, and write an explanation if required.

1. The terms 'medium for instruction' and 'instructional technology' are synonyms.  
T or F
2. There is a difference between interactive technologies and presentation technologies.  
T or F
3. Printed textbooks are technology tools for delivery.  
T or F

4. There is no significant difference in learner achievement between those who are taught with the Internet and those taught with traditional methods.  
T or F

Explain your answer.

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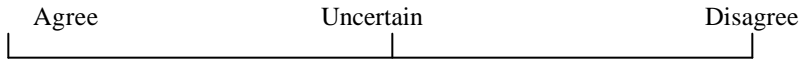
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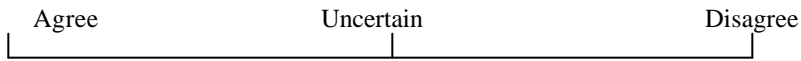
**ii) Assessing Personal Attitudes Towards Technology**

*Directions:* Place an “x” on the continuum to represent your feelings towards the statements below.

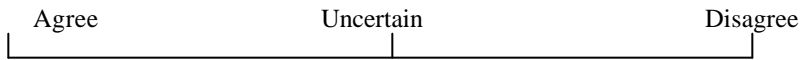
1. Technology should be integrated into teaching and learning from the cradle to the grave.



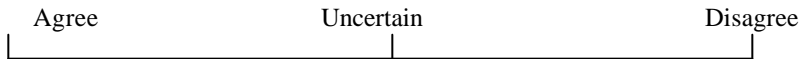
2. New technologies for use in the classroom are more important than traditional basic supplies.



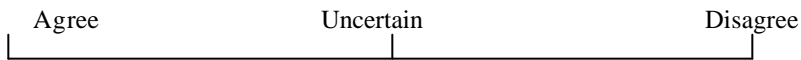
3. Computer-mediated teaching will soon make teachers redundant.



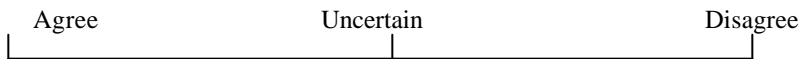
4. Today’s learners, who are more literate than their own teachers, threaten me.



5. I am not confident with my skills to try new technologies.



6. Today’s learners, who are very computer savvy, are less creative than learners who are less exposed to computers.



### C. Technological Tools

#### Assess your knowledge of Technological Tools.

In the second column of the table below, place a checkmark next to the technological tools that you are comfortable using and make a cross by those you would like to be able to use. In the third column, give your comments on how you plan to improve your skills to use those tools.

Medium	Technology tools for Delivery	Comments for Improvement
Face-to-Face contact	Presentation Aids: Black or white board _____ Overhead projector _____ Data projector _____ Slide projector _____	
Text (including graphics)	Printed textbook _____ Web-based textbook _____ Facsimile _____ Computers _____ (Including a range of applications such as e-mail, electronic databases, World Wide Web hypertext documents, FTP or ASCII documents, CD-ROM)	
Audio	Audiocassette _____ Radio broadcast _____ Telephone _____ Computers (with related applications) _____	
Video	Television Broadcast (Terrestrial, satellite or cable and including narrowcast educational television) _____ Videocassettes _____ Video disc _____ Videoconferencing _____	
Integrated Multimedia	Computer-mediated learning environments _____ (This could be stand alone or networked and with numerous possible ways to access all media through a single technology)	

#### Knowledge of Computer Operations

*Directions:* In the right-hand column, circle the letter(s) that indicate your knowledge about computer uses.

K = I Know    DK = I Don't Know

Graphic User Interface	Performance Task		
Use of toolbar, menus, and dialog boxes	Locate and use features on a toolbar. Locate and select items on menus. Locate and respond to dialog boxes.	K	DK
Menu Shortcuts	Identify and use menu shortcuts.	K	DK
Selecting	Select tools and other features within a GUI.	K	DK
Click, Double Click/Right Click,	Demonstrate clicking, double-clicking, right clicking (on PC), command clicking (On MAC), and dragging.	K	DK

Drag			
Window	Identify and use the functions of a window.	K	DK
Scrolling	Scroll up and down a window.	K	DK
Resizing	Resize a window.	K	DK
Closing	Close a window.	K	DK
Application Software	Performance Task		
Launching	Launch an application.	K	DK
Creating files	Create a file.	K	DK
Saving	Save a file.	K	DK
Common features	Identify the features that most applications have in common.	K	DK
<b>Basic four productivity applications</b>	<b>Performance Task</b>		
Word processing	Demonstrate the use of a word processing application.	K	DK
Spreadsheet	Demonstrate the use of a spreadsheet application.	K	DK
Database	Demonstrate the use of a database application.	K	DK
Graphics	Use a graphic application.	K	DK
<b>File Management</b>	<b>Performance Task</b>		
Saving a file on a hard drive	Save a file on a hard drive.	K	DK
Saving a copy of same file at different location	Save a copy of same file at different location.	K	DK
Creating file folders	Create a new file folder. Save/Move files to a folder.	K	DK
Finding a directory from a pathname	Find a directory from a pathname.	K	DK
Naming conventions	Recognize and use file -naming conventions (as they may appear on a MAC and a PC).  Explain the importance of using the correct naming conventions.	K	DK
File Recovery	Identify and demonstrate the methods available to recover files and lost data.	K	DK

### Teaching, Learning and Curriculum

**Element of Assessment:** Lesson Plan and Teaching Practice Using Technology

**Performance Task:** Design and Teach Technology Enriched Learning Activities That Maximize Student Learning With Diverse Needs.

**Name of Rubric:** Checklist for Lesson Observation and Assessment Using Interactive and Presentation Technologies

**Last Name:**..... **Initials:**.....

**Student Id:**.....

**Program of Study:**.....

**Subject:**..... **Topic:**.....

.....

**Grade:**..... **Date:**..... **Time:**.....

**Signature of Evaluator/Observer:**..... **Marks:** 5 x 2 = ..... /10 (Each element carries 2 marks)

#### A. LESSON PLAN PREPARATION

DESCRIPTORS	COMMENTS
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Appropriate technological tools were chosen. Technology relevant to the topic and logically integrated in the lesson.	
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*B. LESSON PRESENTATION*

<b>DESCRIPTORS</b>	<b>COMMENTS</b>
Effective and skillful use of technological tools Technology chosen is purposeful and gained immediate attention from the class. Achieved appropriate content of the lesson.	

*C. HANDLING OF TECHNOLOGICAL EQUIPMENT*

<b>DESCRIPTORS</b>	<b>COMMENTS</b>
Knew all the operations of the technological tools	

*D. SENSITIVITY TO DIVERSE NEEDS*

<b>DESCRIPTORS</b>	<b>COMMENTS</b>
Technology used was sensitive to the special needs of individual identities. Technological tool used communicated to different sectors of the class.	

*E. GENERAL IMPRESSION OF THE STUDENT TEACHER*

<b>DESCRIPTORS</b>	<b>COMMENTS</b>
Used a variety of technological tools and looked confident, enthusiastic and enjoys teaching with technology.	

**AECT Presentation Conclusion**

The presentations were based on the International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS) for Teachers.

The class included students from varying professional backgrounds. We believe that all students, regardless of professional and academic background, found the assessment of these standards important to the success of their implementation. In evaluating these standards, most students found that creating an assessment process was difficult because it involved a great deal of compromise as well as huge amounts of time to complete the assessment of a standard.

Despite the difficulties it was an extremely rewarding process because we were given experience of the difficulties and challenges inherent in any educational assessment.

# Strategies for Building Integrated EPSS

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## Abstract

*Because the complex link and node structure awaiting users can lead them into becoming lost in hyperspace and cause them cognitive overload, navigating the hypertext system is often not an easy task, especially for novices. They have a difficulty perceiving a structure a structure of entire system, locating specifying information, using navigational aid. This phenomenon can be more expected in the highly structured EPSS. In that point, content providers or designers for web-based integrated EPSS should know how to design interface and information structure based on its content and purpose. This study analyzed four interface design methods (simple selection menu style, menu with global navigation, menu with global and local navigation, and pull-down menu) and four information structures (linear structure, grid, hierarchy, and network) in terms of the complexity, flexibility, navigation, domain knowledge, and cognitive load. Based on this analysis, guidelines for building the integrated web-based EPSS effectively are provided.*

## Introduction

Building an effective EPSS has been a major issue not only in business but also in education and government. As more people come to depend on the use of computers and networking to perform their jobs, and as hardware and software technologies continue to advance, the potential for EPSS appears tremendous (Collis & Verwijs, 1995; Malcolm, 1998; Ockerman et al., 1997).

Hypertext and hypermedia system enabled designers and programmers to tile all performance support system elements together in a way that allowed users to follow their own streams of thought in searching for information (Gery, 1991). Hypertext is such a technology that provides a powerful new way of organizing, displaying, and accessing information that could affect all forms of systems (Shneiderman and Kearsley 1989). Hypertext consists of the associative links between multiple nodes, which are one or more parts of information, forming an interconnected networked (Nelson 1974; Conklin 1987). The linking system in the hypertext system allows users to browse through the system utilizing navigational tools (Eklund 1995). However, navigating the hypertext system is often not an easy task, especially for novices (King, 1996). The potentially complex link and node structure awaiting users can lead them into becoming lost in hyperspace (Nielsen 1990) and cause them cognitive overhead (Conklin, 1987). Users have a difficulty perceiving a structure of entire system, locating specifying information, using navigational aid. This phenomenon can be more expected in the highly structured EPSS.

Such problems have prompted research on the manner in which users interact with hypertext system. Usable design guidelines and principles for navigation can maximize coherence of integrated EPSS and minimize users' cognitive overhead and disorientation.

## Interface design

When designing an integrated EPSS, two important issues are involved: 1) interface design - how to present link system that provide access to the structure, and 2) information structure - how to incorporate the original structure of the content into the structure of an EPSS.

Interface design is basically concerned with the presentation of text, graphics, and linking system on the screen. It provides a contextual or structural model for the specification of the logical and functional organization of the user interface component, as well as a communication and means between users and system (Laverson, Norman

et al. 1987; Norman and Chin 1988; Lai and Waugh 1994; Oliveira, Goncalves et al. 1999). Many researchers has been agreed that interface should be designed to provide users efficient and effective organizational model that can help users understand the entire system and navigate system to find information without getting lost or cognitive overload (Lai and Waugh 1994; Dieberger 1997; Shneiderman 1997; Schenkman and Jonsson 2000).

Interface on an EPSS provides three major roles for navigation; 1) presenting links, 2) supporting structural cues, and 3) providing path mechanism. The interface is the most immediately visible part when a system was user-centered (Nielsen 1990). The most fundamental function of interface is to display links one the screen so that a user could navigate through a system (Shneiderman 1998). Selecting the links is frequently difficult to navigate in spite of the fact that a graphical browser provides the easy to navigation method, "point and click." One factor of difficulty in selecting paths for navigation is the presentation of link system. The user navigation performance can be influenced by the design and placement of links (Carlson and Kacmar 1999).

The second role is to support the user perception of structural cues for an effective navigation. If the interface does not provide appropriate structural information, users cannot perceive where they are and cannot decide where to go. Users also could experience "lost in space" (Dieberger, 1997).

Information is structured by links and users follow paths developed by designer. As a result, if interface design provides the flexible path mechanism that can allow users to jump to the information directly without passing pages that are not necessary to get the information, users could find information fast. However, there is some possibility to increase user's cognitive load without providing structural and navigational cues.

There are four generally used interfaces for navigating the web site: 1) simple selection style, 2) global navigation aid, 3) global and local navigation, and 4) pull-down menu styles.

### **1) Simple Selection Menu Style**

One type of menu style is simple selection menu style, which is much similar to a table of contents for a print book (Chimera and Shneiderman 1994). In this menu style, a user can go to deeper levels of the web site by selecting links presented in the current web page. The major drawback of this menu style is that a user has a difficulty in perceiving the entire structure of the web site (Chimera, 1994), since when a user moves into lower levels, previous menu is replaced with new level. Another drawback of this menu style is that a user is unable to traverse to beyond below level because a user has to wait for a new below level select link again before moving lower level and select the link below level again. An experienced user is unable to navigate faster than that that of novice and this is inefficient and frustrating for experienced users (Laverson, 1987).

### **2) Global Navigation Aid Menu Style**

The second menu style is persistent menu that has two split parts. The links on the top level remain in the similar area on the left all the time. The content is located in the area on the right and is replaced by its subsequent menu when users move other pages. The advantage of this menu style is that a user can go to each page of the top level by clicking top level links on the left side from any page in the web sit and that it provides the global structural cue to users (Nanard and Nanard 1991).

### **3) Global and Local Navigation Menu Style**

The third menu style has two parts of navigation link for global level and local level (Nanard & Nanard, 1991). The navigation links of top-level pages on the web site usually place on the top of web page and the navigation links of current level pages on the web site usually place on left side. The advantage of this menu style is to provide not only global structure cue with the top-level navigation links but also local structure cue with current level navigation links (Furnas 1997). A user can skip several levels in the web site and it can more efficient than other menu design because a "jump-ahead" capability can reduce the time to navigate and find information (Laverson, 1987).

### **4) Pull-Down Menu Style**

Pull-down menu style appears over objects in the interface instead of in static menu area. Pull-down menu allow users with a mouse to access the Web page they want directly. The advantage of the menu style is jump to the any page with mouse move and click. However, users can be disoriented or get lost since this menu can't provide structural cues. This menu style would be useful for experienced users.



Table 1. Summary of Menu Style

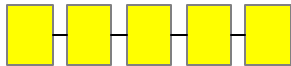
	Use	Complexity	Flexibility	Access Speed	Disorientation
Simple Selection	Easy	Low	Low	Slow	Low
Global Navigation	Easy	Middle	Middle	Middle	Middle
Global & Local Navigation	Hard	High	High	Fast	High
Pull-Down	Middle	Very High	Very High	Very High	Very High

## Information Structure

The structure of a hypertext system can take many different forms. Four basic structures are linear, grid, hierarchical, and network structure. However, a web-based integrated EPSS can be designed with more than one structure.

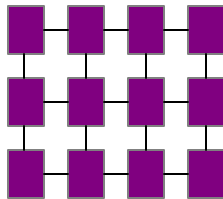
### 1) Linear Structure

The simplest way to organize information is in a sequence based on chronological or logical orders. Typically it is useful structure to retain the original documentation. Linear structure can be used for guided tour, job aids, tutorials, and demonstration of procedure in Web-based EPSS.



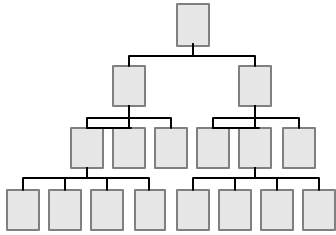
### 2) Grid

Grid structure organizes multi-dimensional concepts or categorizations. A series of procedural manuals and list of training courses and materials can be best organized. Grid structure can be organized with one concept or categorization in horizontal axis by vertical axis with other concept or categorization. Unfortunately, grid structure can be difficult not only to organize but also to understand unless the designer or user recognizes the interrelationships between concepts and categorizations of whole information. Therefore, it is best for who already have knowledge on topics and its organization (Lynch 1999).



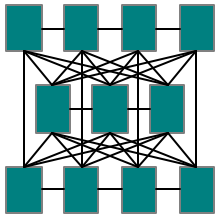
### 3) Hierarchy

A hierarchical structure has been used widely in the web site (Lynch, 1999), on-line documentation (Gloor 1997), information retrieval system (Rosenfeld and Morville 1998), and computer-based instructional programs and training (Lai, 1994; Jonassen, 1986). Organization of hierarchical structure starts with general concept or topic into specific ones, which are in turn divided into more specific to individual based on precedence and significance (Lynch, 1999; Norman, 1988; Sano, 1996). Users can move from general to specific and back to general through the linking system presented by menu design. The advantage of hierarchical structure is that familiar to most people since it reflects the structure of printed materials (Shneiderman and Kearsley 1989), it is ubiquitous in everyday life (Sand 1996), and it is the most natural structures for organizing levels of abstraction (Gloor, 1997). Because of its familiarity and pervasiveness, users can easily and quickly understand web sites and hypertext system (Rosenfeld, 1998) without heavy cognitive overload. In organized hierarchical information structure, the disorientation problem can be minimized and users can easily navigate among information nodes by following the linking system (Conklin, 1987). They are able to develop a mental model of the site's structure and their location within that structure (Rosenfeld, 1998).



#### 4) Network

Network structure is composed of associative links that network related concepts and information together. While this structure provides relatively effective navigation mechanism, users can easily get lost or disoriented because it is so hard for users to understand and predict entire. This structure can apply on small size of Web site for high level of training, such as simulation game, strategy training. It would be difficult to manage linking system if size is getting bigger (Lynch, 1999).



Most complex web sites share aspects of all four types of information structures. Except in sites that rigorously enforce a sequence of pages, users are likely to use any web site in a free-form "web-like" manner, just as most non-fiction or reference books are used. But the nonlinear usage patterns typical of web surfers do not absolve developers of the need to organize their thinking and present it within a clear, consistent structure that complements design goals for the site. Table 2 shows the characteristics of four basic organization patterns explained above in terms of the complexity, flexibility, easy-to-navigation, domain knowledge, and cognitive load.

Table 2. Summary of Information Structure

	Complexity	Flexibility	Navigation	Domain Knowledge	Cognitive Load
Linear	Low	Low	Very Easy	Low	Low
Grid	High	High	Middle	High	High
Hierarchy	Middle	Middle	Easy	Middle	Middle
Network	Very High	Very High	Hard	Very High	Very High

#### Depth and Breadth

The most discussed issues in information structure are branching factors, depth (the number of vertical levels or links) and breadth (the number of horizontal documents or links) (Shneiderman 1997). Much has been known about tradeoff of "depth and breadth", and "complexity and flexibility issues (Larson, 1998; Shneiderman, 1997). The previous results generally support that deeper hierarchical structure, the less helpful and less favorable for navigation. Users have to move through more levels to located information in the deeper structure and should need more not only cognitive effort but also physical effort to interact with more displays and links for information searching (Shneiderman, 1989).

#### Guidelines for building an integrated EPSS

Design of integrated EPSS can be affected by many factors. These factors include as follows:

##### 1) Analyzing the nature of information or knowledge

In building an effective web-based integrated EPSS, one of the most important things developers have to keep in mind is to analyze the nature of information or knowledge to be supported by the site as exactly as possible. Depending on the professional medical knowledge with a complex information structure or the general knowledge with a simple information structure for its delivery, it might be totally different in terms of the interface design, information structure, and the depth and breadth of the information.

## **2) Analyzing user characteristics**

In order to build an effective web-based integrated EPSS, developers should clearly analyze the characteristics of the target users of the site. That is, the developers need to make a more detailed analysis of the target audiences, such as teenagers, professionals of some fields, and so forth. Based on that analysis, the developers can grasp the major concerns of the audiences and predict their preferences. This will lead to providing appropriate functions just in time when such needs arise. If the EPSS is developed without considering the users' characteristics including their preferences, the site, no matter how well organized or useful, will not appeal to the some portion of the users any more.

## **3) Localizing contents and categories**

Due to the rapid development and spread of communication technology, traditional borders disappeared in the terms of information sharing. In other words, we can share any content as soon as it is developed. Considering the importance of sharing information, this is very desirable. The problem arises for the fact that every country has unique cultural and social context as well as different language. Even in the same country, there can be various cultural groups. Certain problems are expected in the use of certain contents in different countries or cultural groups. For example, item 'I', which is categorized as 'A' in one country, can be categorized as 'B' in another country. There is a need to readjust contents or categories in terms of cultural and social contexts. The easiest solution is to prepare different versions for different groups. Here, the developers may most likely face the effect of tradeoff due to additional cost.

## **4) Analyzing client system capability**

The developers need to be cognizant of the system environment under which the users are learning. This is closely associated with analyzing users characteristics. While the latter is more concerned with physical and affective characteristics of the users, the former is more focused on their learning milieu. With the rapid development of technologies, we have recently seen many products with newly-added features. Even the products marketed in the same year maybe different from one another in terms of system capability. In this vein, the developers need to continue their analysis on the learning environment of the users.

## **5) Analyzing information accessibility**

We cannot overemphasize the importance of information accessibility for building an effective web-based integrated EPSS because the EPSS is delivered via electronic telecommunication technology like Internet. While most users with intent to access to Internet use LAN in their office, they rely on modem at home. So, their major concern is how expeditiously and conveniently they can access the needed information. When they cannot obtain the information they need at their convenience, they will experience inconveniences arising from the use of the site. This will eventually turn the users away from the site. Therefore, high level of information accessibility is very important factor of a successful EPSS.

## **6) Planning information updatability**

Information updatability is another critical issue. In EPSS, this factor is more important than any other fields, because the users want information, which is most recently updated at their convenience. In this regard, two most important issues arise as to how promptly the information can be updated and who will assume the role of updating the information.

## **7) Harmonizing internal relationships between other information sources**

Information in EPSS is sophisticated rather than fragmentary. As seen in Figure 1, even the same types of information can be restored and delivered in various ways. Some information can be delivered by visual formats such as text or graphics or by audible formats such as audio. In this sense, harmonizing internal relationship between other information sources is very important. If the internal relationship is not well organized, the EPSS is just an archive of unrelated, individual information.

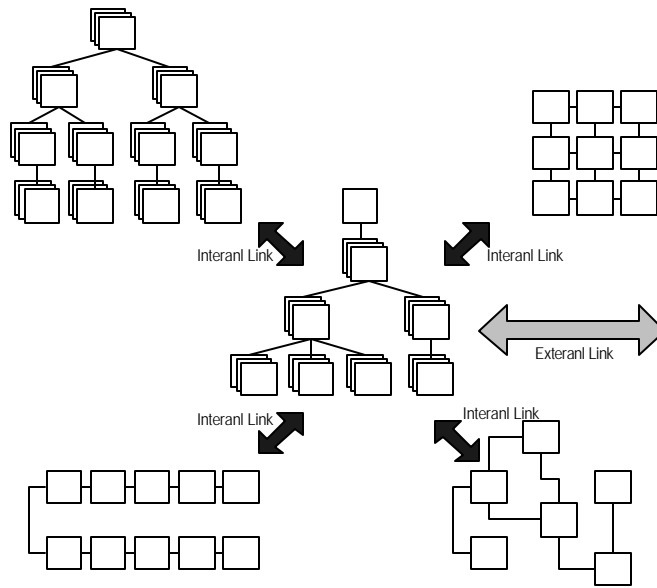


Figure 1. Overall Structure of Web-based Integrated EPSS

### 8) Integrating external relationships between other EPSS

Finally, integrating external relationships between other EPSS is another important issue. The developers should consider that the EPSS has to be related to external sources at some degree in order to maximize its effectiveness. Just as harmonizing internal relationship between other information sources was important, integrating external relationship between other EPSS in a harmonious way is a very important factor of successful EPSS.

All of these factors impact the way to present and structure the web-based integrated EPSS. In order to maximize the usability of web-based integrated EPSS, therefore, we need to identify and select appropriate menu systems and information structures.

### References

- Carlson, J. R. and C. J. Kacmar (1999). Increasing link marker effectiveness for WWW and other hypermedia interface: An examination of end-user preferences. *Journal of the American Society for Information Science* 50(5): 386-398.
- Chimera, R. and B. Shneiderman (1994). An exploratory evaluation of three interfaces for browsing large hierarchical tables of contents. *ACM Transactions on Information Systems* 12(4): 383-406.
- Collis, B. A., & Verwijs, C. (1995). A human approach to electronic performance and learning support systems: Hybrid EPSSs. *Educational Technology*, 35(1), 5-21.
- Conklin, J. (1987). Hypertext an introduction and survey. *IEEE Compute*, 20(9): 17-41.
- Dieberger, A. (1997). Supporting Social Navigation on the World Wide Web. *International Journal of Human Computer Studies*. Special Issue on innovative applications of the WWW.
- Eklund, J. (1995). Cognitive models for structuring hypermedia and implications for leaning from the World Wide Web.
- Furnas, G. W. (1997). Effective view navigation. *Human Factors in Computing Systems CHI 97 Conference Proceedings*, ACM Press.
- Gery, G. (1991). *Electronic performance support systems: How and why to remake the workplace through the strategic application of technology*. Boston: Weingarten Publications.
- Gloor, P. A. (1997). *Elements of hypermedia design: techniques for navigation & visualization in cyberspace*. Boston, Birkhäuser.
- Jonassen, D. H. (1986). Hypertext Principles for Text and Courseware Design. *Educational Psychologist*, 21(4), 269-292.

- King, K., L. (1996). Usability of Hypertext: Factors Affecting the Construction of Meaning. Dissertation Abstracts International, AAC 1380388.
- Lai, Y. R. and M. L. Waugh (1994). *From information searching to learning: A comparison of contrasting hypertextual menu designs for computer-based instructional documents*. The American Educational Research Association, New Orleans, LA.
- Laverson, A., K. Norman, et al. (1987). An evaluation of jump-ahead techniques in menu selection. *Behaviour and information technology*, 6(2): 97-108.
- Lynch, P. J. (1999). *Web style guide: basic design principles for creating web sites*. New Haven, New Haven.
- Malcolm, S. E. (1992). Reengineering corporate training. *Training*, 29(8), 57-61.
- Nanard, J. and M. Nanard (1991). *Using structured types to incorporate knowledge in hypertext*. The third annual ACM conference on Hypertext, San Antonio, TX USA.
- Nelson, T. H. (1974). *Dream Machines: new freedoms through computer screens - A minority Report*. Computer Lib: You can and must understand computers now. Chicago II: Hugo's Book Service 1974 (Nachdruck Microsoft Press 1988)
- Nielsen, J. (1990). The art of navigating through hypertext. *Communications of the ACM*, 23(3): 298-.
- Nielsen, J. (1990). *Hypertext and Hypermedia*. San Diego, Academic Press.
- Norman, K., L. and J. Chin, P. (1988). The Effect of tree structure on search in a hierarchical menu selection system. *Behaviour and Information Technology*, 7(1):51-65.
- Ockerman, J. J., Najjar, L. J., & Thompson, J. C. (1997). Evaluation of a wearable computer performance support system. In T. Muldner & T.C. Reeves (Eds), *Educational Multimedia/Hypermedia and Telecommunications*. Charlottesville, VA: Association for the Advancement of Computing in Education.
- Oliveira, J. L. d., M. A. Goncalves, et al. (1999). A framework for designing and implementing the users interface of a geographic digital library. *International Journal on Digital Libraries*, 2(2/3): 190-206..
- Rosenfeld, L. and P. Morville (1998). *Information architecture for the World Wide Web*. Sebastopol, Ca, O'Reilly.
- Sand, D. (1996). *Designing large-scale web sties*. New York, Wiley Computer Publishing.
- Schenkman, B. N. and F. U. Jonsson (2000). Aesthetics and preferences of web pages. *Behavior & Information Technology*, 19(5): 367-377.
- Shneiderman, B., Ed. (1997). *Designing information-abundant Web site: issues and recommendations*. Web usability (special issue). Available: <http://ijhcs.open.ac.uk/shneiderman/shneiderman-nf.html>
- Shneiderman, B. (1998). *Designing the user interface: strategies for effective human-computer interaction*. Reading, Mass, Addison-Wesley.
- Shneiderman, B. and G. Kearsley (1989). *Hypertext hand-on!: An introduction to a new way of organizing and accessing information*. Reading: MA, Addison-Wesley Publishing Company.

## Problem-Based Learning in Web-Based Science Classroom

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### Abstract

*The purpose of this presentation is to discuss how general problem-based learning model and social-constructivist perspectives are applied to design and develop a web-based science program, which emphasizes inquiry-based learning environment for 5th grade students. The presentation also deals with general features and the learning process of web-based science program, including teacher's action, the student's learning activity, and cognitive tools to scaffold the student's inquiry. A major goal of PBL in web-based science program is to help students' construct scientific thinking and problem solving skills through a set of interaction including teacher-to-student, student to-student, group-to-group, student-scientist, and student-cognitive tools. The main stages of PBL in web-based science program as a learning cycle are 1) "Your Challenge" which students engage in an authentic problem situation, 2) "Plan Inquiry" which students identify what they know, what they need to know to solve a problem, and how they go about finding out, 3) "Explore Resources" which students gather information, learn primary concepts and principles necessary to solve the problem, and contact with scientist to acquire scientific thinking process for solving problem and their perspective about the problem, 4) "Generate Alternative Solutions" which students come up with alternative solutions to the problem after analyzing information and data, 5) "Reflection & Presentation" which focus on feedback from teacher, students, and scientist about alternative solutions. After revising their solutions, students present their best solutions. In this learning cycle, scaffolding or cognitive tools support students' activity to communicate scientific arguments and to solve the problem.*

### Why PBL?

Problem-Based Learning provides minds-on and hands-on experience for students to engage in real world problem (Torp & Sage, 1998). During the Problem-based Learning, students (1) play the role of stakeholders in the problem scenario, (2) engage in an ill-structured problematic situation, (3) identify what they know and need to know, (4) define the problem to focus further investigation, (5) gather and share information related to the problem situation, and (6) generate several possible solutions and identify the solution of best fit (Torp & Sage, 1998; Savery & Duffy, 1996; Albanese, A. M., & Mitchell, S., 1993).

Hewitt and Scardamalia (1996) addresses the why PBL works.

- Inquiry is focused upon communal problems of understanding where meaning is negotiated through questioning, theory refinement, and dialogue.
- Students' ideas about what they need to know become the focus of inquiry.
- Knowledge is shared and held collectively. New information that is shared has the potential of shaping subsequent investigations by others.
- The artifacts of student inquiry are made public and used in knowledge production. These include problem maps that integrate information and highlight connections, graphic organizers that help visualize patterns and relationships, and loop writing that provides opportunities for students to respond to the thinking of their peers.
- Responsibility for planning, organizing, questioning, and summarizing is shared among the students and facilitated by the teacher.

Problem-based learning helps students develop and practice ways to solve problems that are in some way relevant to issues they can relate to. By allowing students to work through problems, they develop reasoning skills and are able to think through real problems more critically. Students are generating their knowledge by themselves with experiences and prior knowledge.

Providing teachers' space about how to coach will give teachers, who are using PBL in their teaching, idea how to scaffold and facilitate in PBL environments.

### Why Web-Based?

In this learning environment, students should be provided feedback to responses made during the learning process. It may be necessary for teacher-to-student, student to-student, and group-to-group, to communicate in the same time frame and have coordinated access to the same World-Wide Web pages. In order to provide responsive feedback, web-based learning environment with interactive media (BBS or Email) is need (Dick & Carey, 1996).

This is designed for classroom study with computers connected with the Internet. Internet will give students have full of chance to search resources. Another reason for choosing web-based learning environment is for any teachers, who have the Internet connection in their classroom, and who want to use this learning environment.

The purpose of this learning environment is to discuss how general problem-based learning model and social-constructivist perspectives are applied to design and develop a web-based science program, (comma) which emphasizes inquiry-based learning environment for 5th grade students. This project also deals with general features and the learning process of web-based science program, including teacher's action, the student's learning activity, and cognitive tools to scaffold the student's inquiry.

A major goal of PBL in web-based science program is to help student construct scientific thinking and problem solving skills through a set of interaction including teacher-to-student, student to-student, group-to-group, student-scientist, and student-cognitive tools. In this learning environment, teachers are active coaches, and students are active students.

### Learning Stages of PBL

PBL is an instructional method characterized by the use of "real world" problems [Figure, 1] "Problem" as a context for students to learn critical thinking and problem solving skills, and acquire knowledge of the essential concepts of the course. Using PBL, students acquire life long learning skills, which include the ability to find and use appropriate learning resources. These problems are used to engage students' curiosity and initiate learning the subject matter. PBL prepares students to think critically and analytically, and to find and use appropriate learning resources.

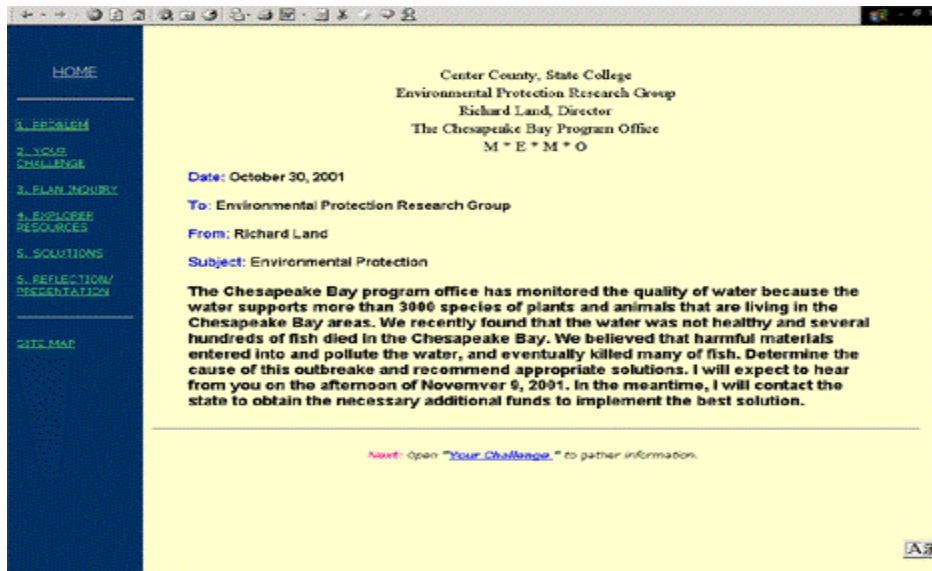


Figure 4 Problem (Screenshot)

After meeting the real world problem scenario, students will be engaged in the five stages to solve the problem. The main stages of PBL in web-based science program for students are (1)

“Your Challenge”, (2) “Plan Inquiry”, (3) “Explore Resources”, (4) “Generate Alternative Solutions”, and (5) “Reflection & Presentation

**Your Challenge**

Students engage in an authentic problem situation. In “Your challenge” stage, students assign the role based on problem scenario and situation by discussions and negotiations with other members of group [Figure 2]. Groups were made up of three to four students.

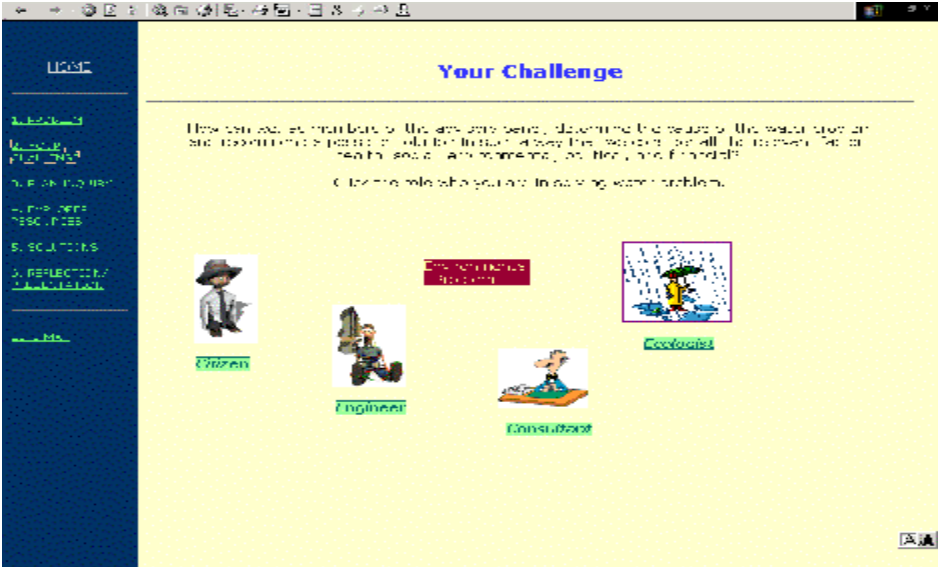


Figure 2 Your Challenge Stage (Screenshot)

**Plan Inquiry**

Students identify what they know, what they need to know to solve a problem, and how they go about finding out [Figure 3]. "I Know This" which students will have to prove what they know from meeting the problem

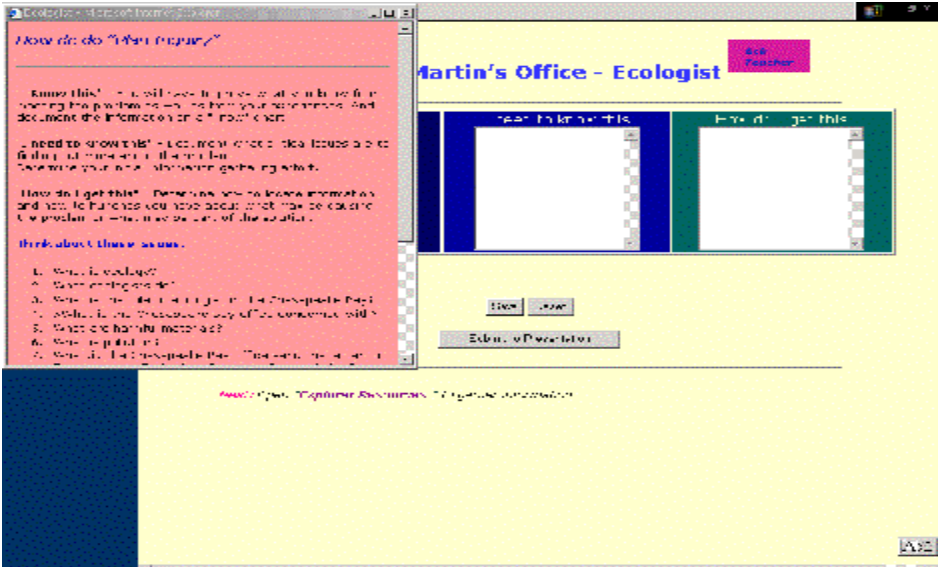


Figure 3 Plan Inquiry Stage (screenshot)



as well as from their experiences, and document the information on a "Know" chart. "I need to know this", which document what critical issues are to finding out more about the problem. Determine students' initial information gathering effort. "How do I get this" which determine how to get information, and how to hunches students have about what may be causing the problem or what may be part of the solution. Under the guidance of a teacher, the students must take responsibility for their own learning, identifying what they need to know to better understand and manage the problem on which they are working and determining where they will get that information. This allows each student to personalize learning so as to concentrate on areas of limited knowledge or understanding, and to pursue areas of interest.

### Explore Resources

Students gather information, learn primary concepts and principles necessary to solve the problem, and contact with scientist to acquire scientific thinking process for solving problem and their perspective about the problem. Resources will be different by student' role, for example, ecologist will have and gather information that appropriate and relate information to him/her, so that student will became an ecologist.

### Generate Alternative Solutions

Students come up with alternative solutions to the problem after analyzing information and data, and recommend solutions based on the information students have gathered using the Decision-Making Matrix [Figure 4]. From the information students have gathered, students will have to come up good judgments supported by criteria, context, self-correction, and explicit reasons for drawing a conclusion, note the strategy, pros, cons, and consequences which are discussed with your group member in the box, and assign a score to each pro or con, from 1 (weak) to 5 (strong) using the Decision-Making Matrix for the their final solution.

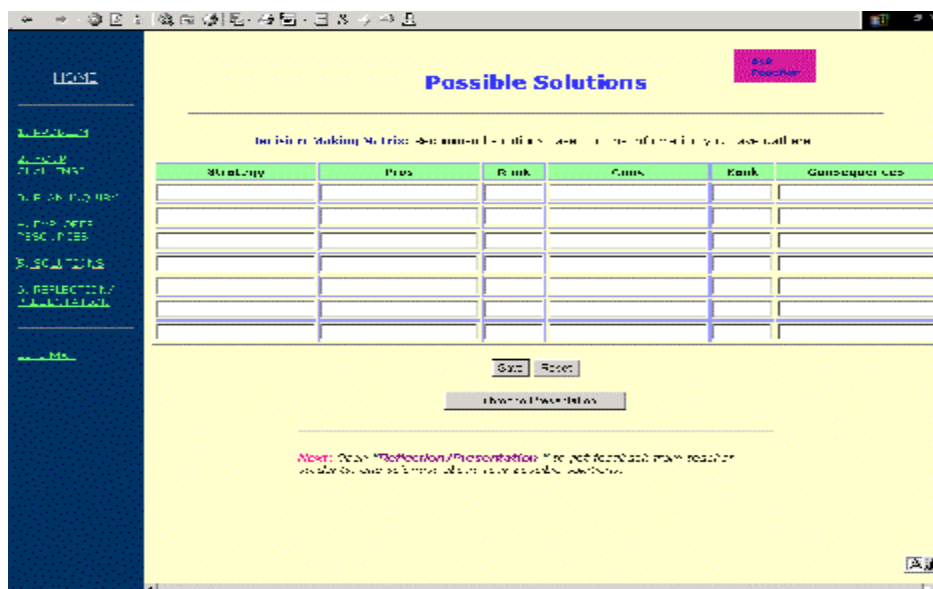


Figure 4 Possible Solution Stage (screenshot)

### Reflection & Presentation

Focus on feedback from teacher, students, and scientist about alternative solutions [Figure 5]. After revising their solutions, students present their best solutions. After revising their solutions, students present their best solutions. When students finish each "Plan Inquiry", and "Solutions" they will show this stage. By clicking button, which is under "Plan Inquiry", and "Possible Solutions", each student can review other student's work. And send an e-mail to give feedback or comments.

STUDENT NAME	E-MAIL	Role	Plan Inquiry	Possible Solutions
Student A	studenta@edu.sa	Reflector	Plan Inquiry	Solution
Student B	studentb@edu.sa	Engineer		
Student C	studentc@edu.sa	Client		
Student D	studentd@edu.sa	Consultant		
Student E	studente@edu.sa	Engineer		
Student F	studentf@edu.sa	Client		
Student G	studentg@edu.sa	Facilitator		
Student H	studenth@edu.sa	Consultant		
Student I	studenti@edu.sa	Client		
Student J	studentj@edu.sa	Engineer		
Student K	studentk@edu.sa	Facilitator		
Student L	studentl@edu.sa	Reflector		

Figure 5 Reflection and Presentation Stage (screenshot)

### Ask Teacher

In the stages of Plan Inquiry and Possible Solution, students will have “Ask Teacher” that works as a model for supporting students’ work through the process of problem solving.

### Teachers’ guidelines

In each stages, teachers will have guidelines about “what is coaching” and “how and what do I coach?”[Figure 6]. The PBL teachers are facilitator or activators of the students’ learning initiatives. Working to guide, motivate, and probe the students’ reasoning process as they journey through the problems rather than to direct it is often a less comfortable role, and requires a blend of creativity, ingenuity, and flexibility in its implementation. Designing problem-based learning in web-based environment is more beneficial to provide and

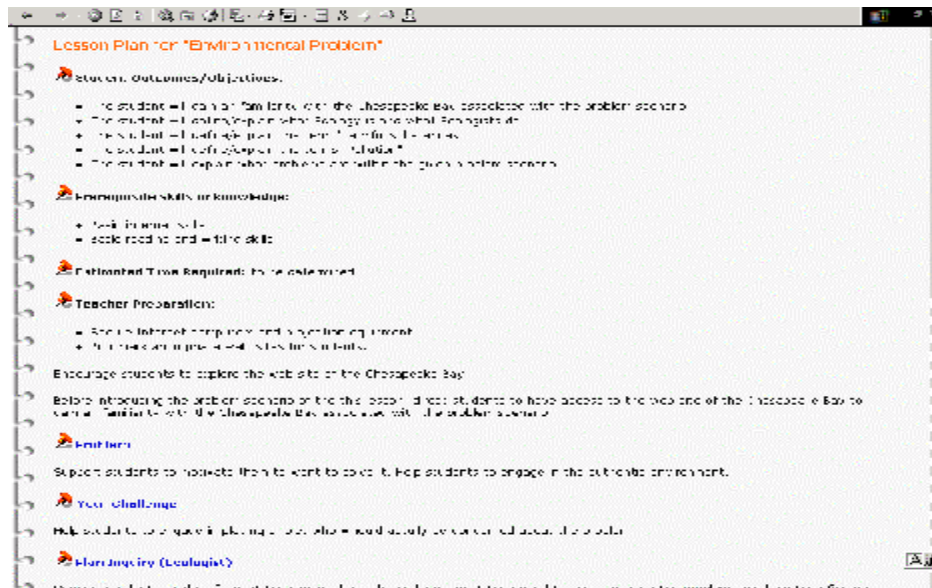


Figure 6 Teachers' Guideline (screenshot)

support scaffolding. Most web-based instruction just ignores the teacher's role and interface. We can hardly capture the teacher's work place in the web-based learning. Teachers just give students feedback. However, teachers only guide students through the process of problem solving, and they provide no direct answers for the questions. Teachers using PBL face the difficult task of guiding without leading, assisting and directing. Teachers' work in PBL involves guiding students through the process of developing possible solutions, and determining the best solutions with the justification.

Teachers' role should be in form of questioning, cueing, prompting, coaching, modeling ideal performance, mentoring, telling or discussing. Teachers can maintain joint attention on a goal by adopting PBL process, using role and drama, managing group work, and monitoring student engagement.

If student provides an accurate but incomplete explanation, teachers are likely to provide a recast or expansion of the student's explanation. Teachers deliberately plan their presentation of problems to facilitate the asking of thought-provoking questions that involve the comparison of different problems or problem-solving techniques.

## References

- Albanese, A. M., & Mitchell, S. (1993). Problem-based Learning: A review of literature on its outcomes and implementation issues. *Academic Medicine*, 68(1), 52-81.
- Dick, W., & Carey, L. (1996). *The systematic design of instruction* (4th ed.). New York: HarperCollins Publishers Inc.
- Duffy, T. M., & Savery, J. R. (1994). Problem-based learning: An instructional model and its constructivist framework. In Brent G. Wilson (Ed.). (1996). *Constructivist learning environments: Case studies in instructional design*. Englewood Cliffs, NJ: Educational Technology Publications.
- Torp, L. & Sage, S. (1998). *Problems as possibilities: Problem-based Learning for K-12 Education*. Alexandria, VA: Association for Supervision and Curriculum Development.

# Engaging Online/Web-based Learning Students in Discussion

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## Introduction

“Discussion” according to The American Heritage College dictionary (1997) is “a formal discourse on a topic.” Likewise online discussion is a formal discourse on a topic; however, it is done electronically either synchronously or asynchronously.

Online/web-based course instructors often find that they have more discussion with their online students than their classroom students (Ekhaml, 2000). However, there is still a perception that online/web-based learning is too textual, requires the student to learn on his/her own, and alienates students from the instructor and other students in the class (Hutton, 1999). For these reasons, discussion is important to an online/web-based course. Discussion helps reduce feelings of isolation, facilitates a spirit of community, and supports achievement of course goals. Being able to engage students in discussion that relates to the course when teaching an online course can sometimes be a challenge. Keeping the discussion to the topic can be an even bigger challenge.

As with traditional face-to-face classes, in electronic/online classes there is instructor-to-class discussion, student-to-instructor discussion (and vice versus) and student-to-student discussion. Fortunately, technology provides several media that supports efforts to engage students in discussion. Discussions can be conducted with email, threaded discussion, synchronous chat, list serves/bulletins, and planned face-to-face meetings.

## Ways in which online discussions can occur

### Email

Email enables the instructor to communicate with one or many students asynchronously. In addition, to giving specific feedback to queries from students, the instructor can email announcements or content-related information to the students. Email can also be used for office hours – students can email the instructor during the specified office hours and know that a response is forthcoming within the confines of the office hours.

Often students will communicate more frequently with an instructor via email than they do face-to-face when in a traditional classroom. Additionally, students can interact with one another via email. Students can submit individual assignments, work collaboratively on assignments, request technical assistance or query the instructor about content-related issues via email. Instructors can return assessments to assignments, provide support for technical and/or content-related issues, and make announcements via email.

A consideration to communicating via email is that students tend to want the responses to be immediate; i.e., within hours or the same day. The instructor should make clear how often email is retrieved and provide a timeframe in which students can expect a response. Another consideration to using email is the use of language. Students tend to communicate differently when communicating via email. For example, their frustration may read like anger, statements originally meant to be humorous may be offensive, and persistence may appear to be coercive. To minimize frustration and misunderstanding the instructor should identify expectations for communicating via email. The instructor should be sure to tell students the timeframe that responses will be given to their emails and whether responses will be given over the weekends and during semester breaks. Also, a few rules of Netiquette with the students are helpful. A few rules of Netiquette regarding email include

- Never say in email what you would not say to your reader's face
- Be ethical
- Proofread before clicking the send button
- Do not type in all capital letters; it reads as though you are shouting
- Be polite
- Be concise
- Fill in the subject line
- Avoid spamming
- Include a signature line that contains your full name, telephone number, office address, and email (The Netiquette Home Page <http://www.albion.com/netiquette> - available 11/4/01 and Dark Mountain's Netiquette Guide <http://www.darkmountain.com/netiquette> - available 11/4/01)

The use of emoticons and acronyms in email are also useful. They enable the writer to say something or portray an emotion concisely; for example, AFAIK means 'as far as I know', NRN means 'no reply necessary' and POA means 'point of advice'. (Netiquette Home Page-A Service of Albion.com; available at <http://www.albion.com/netiquette> - 11/4/01, Dark Mountain's Netiquette Guide; available at <http://www.darkmountain.com/netiquette> - available 11/4/01)

### **Listserve/Bulletins**

Listserve are similar to email in that they are asynchronous. Unlike email everyone that is a member of the listserve receives the submissions to the listserve. List serves/Bulletins support structured or unstructured discussion.

### **Threaded Discussions**

As with email, threaded discussions allow the student to have discussion with the instructor as well as with classmates. Because threaded discussions are asynchronous, students can give careful consideration to their responses and post them at their convenience. When focused on a specific topic, the discussion can be quite engaging. To keep the discussion on track, online instructors can design questions that pertain to a particular article or class reading thus requiring students to focus on the course content for the discussion. Narrowing the topic to address specific questions related to the course content helps to keep the discussion from becoming fragmented (Ko & Rossen, 2001). Beaudin (1999) suggests that online instructors write questions that specifically elicit on-topic discussion, provide guidelines for on-topic responses, reword the original question when responses are no longer on topic, and provide a discussion summary. Another means of keeping the discussion on track is for the online instructor to respond to the students' responses. Students look to see if the instructor is engaged in the discussion and pattern themselves accordingly. According to Ko and Rossen (2001), "when students see that an instructor only rarely engages with them, they are discouraged from posing questions and comments aimed even indirectly at the instructor, and they may conclude that the instructor will be unaware of what is going on in the classroom" (p.227).

Regarding student responses, the instructor can provide guidelines for this as well. Guidelines might include having students:

- Respond in complete sentences with little no errors in spelling, grammar and punctuation
- Indicate support for their response from the assigned reading or other literature
- Respond a minimum number of times and with more than a mere 'I agree with ...'
- Respond within a certain timeframe (e.g., one week) to ensure that the discussion does not linger and lose its momentum all together.

In some instances, the online instructor may feel it necessary to assign points to contributions to threaded discussions. Specific criteria regarding participation should be detailed in the course syllabus. The grading criteria can be based on the quantity as well as the quality of participation. Regarding quantity, the instructor might require that students post a comment or question to the discussion within a specified timeframe (Ko & Rossen, 2001). The quality of the responses might be assessed on how well students address the question by paraphrasing information from the readings and citing/quoting supporting literature.

Activities that are supported by threaded discussion include online debates, case studies, article discussions, collaborative projects, guest speakers, and open discussion (Ekhaml, 2000). Each of these activities with the exception of the open discussion requires that there be a topic or question that drives the discussion; thus, keeping the discussion on track.

### **Synchronous chats**

Synchronous chats (chats) allow the students to feel a sense of community with one another and the teacher. Chats facilitate collaborative projects, enable students to get clarity about assignments, and supports discussion whether it is structured (i.e., focused on a specific topic) or unstructured (i.e., open forum with most topics being appropriate). Chats also require that everyone be online at the same time and can be text-based or voice or video enhanced. Because scheduling can be a problem for some students, it is best to schedule more than one time in which students can participate. As with threaded discussions, participation expectations (e.g., minimum number of postings, quality of postings, points associated with postings, identify person one is responding to) should be specified prior to the start of the chat and the chat should have a focus.

Debates/collaborative discussions, article discussions, expert speaker, and software reviews are a few activities that are suitable for chats. Each of these activities has a purpose, can be facilitated by either instructor or

student, and can have a specified time frame. Kirby (1999) found that students were more comfortable with debates via chats after the second occurrence. When students submit their points and counterpoints, it can be confusing and discussion can appear chaotic since someone may be responding to a person's comment two or three comments above. Having several small group chats might help alleviate the chaotic nature of chats since fewer people are "chatting".

### **Planned face-to-face meetings**

When logistics permit, planned face-to-face meetings can support and prompt more online discussions. During the meetings, everyone is able to put a face to the names of the individuals they will/ have been communicating with online. Such name-to-face recognition nurtures community among the students. Cooper (2000) particularly encourages having an initial class meeting because it lets students meet the instructor and each other, ask questions, and learn about the course assignments, assessments, required materials, office hours and the online software. Subsequent face-to-face meetings can support the students in their efforts to complete assignments and/or get clarity about assignments as well as nurture the affective needs of the online students.

### **Lessons learned**

Teaching online was a learning experience for me as well as for my students. I had assumed that my students had certain technology skills and had taken the online course orientation, which would familiarize them with the online software features. This was not an accurate assumption, and I learned that one should never assume anything when teaching online. Instead I should have had a face-to-face meeting to meet my students in person, demonstrate use of the online course, orient them to the course expectations, and as a consequence have a positive impact on our learning community. Fortunately, I did have a face-to-face meeting about a month into the semester and it created an atmosphere that was supportive and friendly for all of us. The new atmosphere was evident in the email communications that I received from the students. Prior to the face-to-face meeting some emails were cryptic and terse as well as offensive; after the face-to-face meeting the emails were clear, detailed and in most cases non-offensive. Having variety in the ways in which students could communicate was a definite plus as indicated by my positive course evaluations regarding online communication strategies. We used email, message boards for announcements, document sharing to peer review, focused threaded discussions, focused chats, and face-to-face meetings. In an online course it is important to communicate/discuss issues frequently. One means of communicating that I did not utilize in my class was group projects; however, in subsequent online courses I will. Collaborative projects increase students' motivation, support their need for familiarity with others, and support the learning community (Ekhaml, 2000).

Knowlton, Knowlton, & Davis (2000) suggest that to facilitate discussions for maximum learning the instructor should make students responsible for participation, model appropriate participation, synthesize students comments, and ask questions to encourage elaboration and clarification. I have learned that following this model will help me create an online learning environment that is friendly and supports students in achieving course goals. This is the type of online learning environment that I as an instructor want to create and maintain.

### **References**

- Beaudin, B. P. (1999). Keeping online asynchronous discussions on topic. [Electronic Version]. *Journal of Asynchronous Learning Networks* (3) 2. Retrieved January November 7, 2001  
<http://www.aln.org/alnweb/journal/jaln-vol3issue2.htm>.
- Cooper, L. (2000). Online courses – tips for making them work. *T.H.E. Journal*, 27, 86-92.
- Dark Mountain's Netiquette Guide <http://www.darkmountain.com/netiquette> - available 11/4/01.
- Ekhaml, L. (2000). Tips for promoting collaboration and interactivity in online distance learning. [Electronic Version]. *Compute-Ed*, 5. Retrieved March 3, 2001, from  
<http://computed.coe.wayne.edu/Vol5/Ekhaml.html>.
- Hutton, S. (1999). *Course design strategies—traditional versus on-line. What transfers? What doesn't?* Paper presented at the Annual Meeting of the American Association for Adult and Continuing Education, Phoenix, AZ.
- Kirby, E. (1999). Building interaction in online and distance education courses. Paper presented at Society for Information Technology & Teacher Education International Conference, San Antonio, TX.

- Knowlton, D. S., Knowlton, H. M. & Davis, C. (2000). The whys and hows of online discussion. Syllabus, 54-55.
- Ko, S. & Rossen S. (2001). Teaching online - A practical guide. Boston, MA: Houghton Mifflin Company.
- The American Heritage College dictionary (1997). 3<sup>rd</sup> edition. Boston, MA: Houghton Mifflin Company.
- The Netiquette Home Page <http://www.albion.com/netiquette> - available 11/4/01.

# Usability Evaluation of an Educational Electronic Performance Support System (E-EPSS): Support for Teacher Enhancing Performance in Schools (STEPS)

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## Abstract

*The concept of EPSS (Electronic Performance Support System) originated in business settings. Recently, there have been many attempts to apply the concept to schools: educational EPSSs (E-EPSSs) have become available on the Web. However, there is little evaluation research and few evaluation frameworks for these emergent E-EPSSs. The primary purpose of this article is to provide our design recommendations for how to improve the quality of E-EPSSs in general, based upon the evaluation of one specific E-EPSS, called STEPS (Support for Teacher Enhancing Performance in Schools). To achieve this purpose, the article first reviews E-EPSSs in terms of teachers' professional development and discusses their encompassing trends, needs, and definitions. Secondly, it presents an evaluation case of STEPS. An evaluation perspective called "perception-oriented usability evaluation" drives the evaluation. Lastly, it lists recommendations for improving STEPS as well as E-EPSSs in general based on our STEPS evaluation results and literature review.*

## Introduction

An exponential increase in information requires teachers to continuously develop their professional skills. As a response to this requirement, many researchers have proposed creating an EPSS (Electronic Performance Support System) to support instructional design activities, which is one of the main tasks of the teachers, through job-embedded learning (Reigeluth, 1999; Gustafson, 1993), and to promote training in education (Scales, 1994). EPSS has also been acknowledged as a system that can assist the school reform movement rather than a mere tool that may exert its influence in only a piecemeal way (Northrup & Pilcher, 1998; Scale, 1994). Applying an EPSS systemically not only can alleviate instructional and administrative burdens by supporting teacher performance, but also can provide teachers with job-embedded training opportunities. Using an EPSS, teachers can receive training within their teaching context. They don't necessarily need to leave their classrooms and school environment to improve their professional skills.

The concept of EPSS originated in business settings; however, recently, there have been many attempts to apply the concept to schools (Barker & Benerji, 1995; Northrup & Pilcher, 1998), and some educational EPSSs (E-EPSSs) have become available on the Web. However, there is little evaluation research and correspondingly few evaluation frameworks for these emergent E-EPSSs. In response to this scarcity of evaluation research, this article describes an evaluation study on one E-EPSS, called STEPS (Support for Teacher Enhancing Performance in Schools.) The article is composed of the following sections:

- Overview of the general features of a selected E-EPSS, STEPS.
- Review of E-EPSS as embedded in teacher professional development and its encompassing trends, needs, and definitions.
- Description of evaluation methodology.
- Results of the STEPS evaluation.
- Recommendations for the improvement of STEPS and the design of E-EPSS in general.

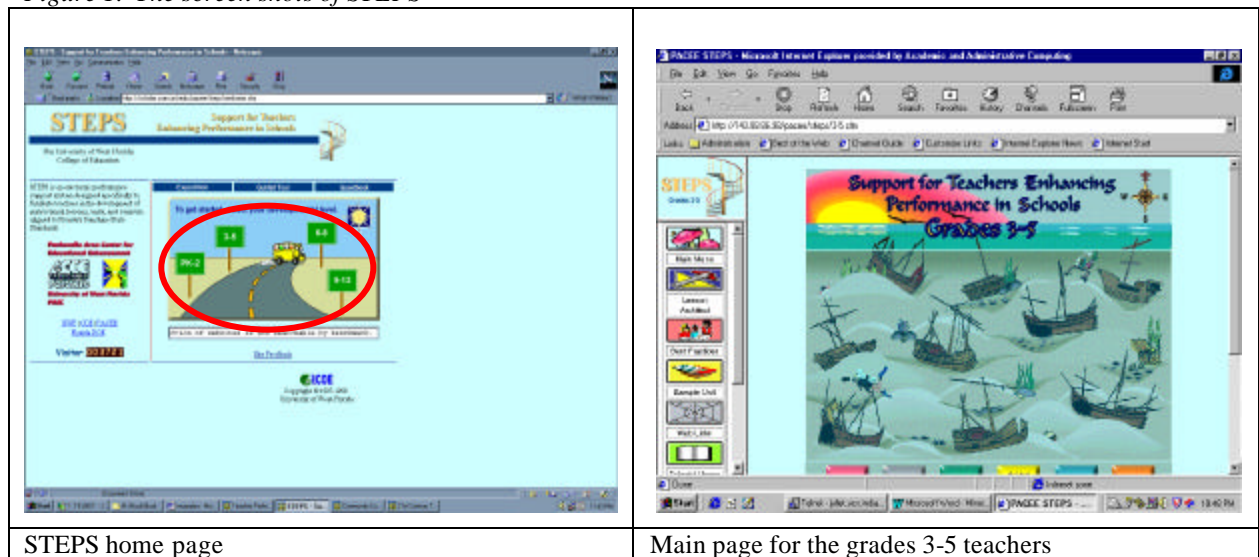
## STEPS as an Evaluand

STEPS (Support for Teacher Enhancing Performance in Schools) is an EPSS designed specifically to help pre-service and practicing pre-K-12 teachers develop instructional lessons, units, and curricula aligned to Florida's Sunshine State Standards. According to Northrup and Pilcher (1998), the purpose of STEPS is to support school reform and sustain accountability of the integrated curriculum that utilizes technology, alternative assessment, and



diverse learning environments and its conceptual frameworks include flexibility, learning by doing, and a user-designed structure.

Figure 1. The screen shots of STEPS



STEPS home page

Main page for the grades 3-5 teachers

STEPS is available through the World Wide Web or as a standalone CD-ROM. The web version of the EPSS was selected for this study. The first picture above is the screen shot of the home page of STEPS. It consists of four menus broken down by the grade level: PK-2, 3-5, 6-8, and 9-12. If the user clicks the signpost marked 3-5, then the main page for the grades 3-5 teachers, which is depicted in the second picture, opens. The main page of grades 3-5 consists of two groups of menus: the left-hand-side frame contains links to the Main Menu, which includes Lesson Architect, Tutorial Library, Best Practices, Sample Unit, Web Links, State Standards, Florida Information Resources Network (FIRN), and Florida Department of Education (FDE), and the right-hand-side frame includes links to the same menus in the left-hand frame. The main page for each grade group has the same menu structure.

The main six components of STEPS are Lesson Architect, Tutorial Library, Best Practices, Sample Unit, Web Links, and Coach. Lesson Architect is the main component of STEPS. It guides teachers through the processes of instructional design and curriculum planning. It uses Gagne’s Events of Instruction (1992) and Dick and Carey’s Systematic Instructional Design Models (1996) as theoretical foundations of instructional design, and various curriculum approaches such as webbing and threaded curriculum (Northrup & Pilcher, 1998).

Tutorial Library is a collection of about forty instructional tutorials. The tutorials follow the four premises of the STEPS curriculum: integrated curriculum, integrated technology, alternative assessment, and diverse learning environment (Northrup & Pilcher, 1998). Some tutorials are linked from the Lesson Architect so that users can get tutorials while they are planning lessons using the Lesson Architect. This function demonstrates one of the main advantages of EPSS—just-in-time support to the users.

Best Practices provide a forum for sharing successful classroom activities that were developed and tested by teachers in their real classrooms. In addition to keyword searches, users can search activities by Sunshine State Standard item or by theme. They can also browse by subject areas. This provides instructional strategies and tactics for designing classroom activities.

Sample Units provide sample curriculum units created by teachers of the same grade level. Grades 3-5 sample units, for example, center around an archaeological theme and provide 10-day model curriculum units. The model units utilize teachers’ cross-curricular connections in Math, Science, Social Studies, and Language Arts and follow the benchmarks described in Florida’s Sunshine State Standards. The teachers used Lesson Architect to create the units.

Web Links include over 400 web sites relevant to Math, Science, Social Studies, and Language Art identified in Florida’s Sunshine State Standards. Each web site is linked to a brief description of the website and a list of applicable benchmarks.

Coach offers three levels of scaffolding: the "big picture" level, the "what do I do" level, and the "how do I do" level. It models the Knowledge Integration Environment created by the University of California, Berkeley (Bell, Davis, & Lynn, cited in Northrup & Pilcher, 1998). If users click “Ask Coach” or a corresponding graphic

icon, a pop-up window appears and provides screen- and field-sensitive help such as descriptions of what the Lesson Architect is or how users can search information on relevant screens. Gery (1991) calls it an extrinsic support that is integrated with the software but not a primary function.

## **Literature Review**

### **E-EPSS as a tool for teacher professional development**

Traditional professional development programs for teachers have stressed knowledge acquisition through workshops and courses. These programs have had difficulties in providing sustained support needed for teachers to apply what they have learned in their classrooms. The performance-centered approach, however, provides such a sustained support by employing more practical knowledge dissemination. Teachers engage in performing processes through which they find problems, organize information, and infer a series of proper decision-making activities needed to solve their classroom problems. Specifically, the new professional development approach engages teachers in a series of concrete tasks of teaching, assessment, observation, and reflection. It is grounded in participant-driven inquiry, reflection, and experimentation. It supports collaboration and knowledge sharing among teachers, and focuses on communities of teaching practice rather than on individual teachers. It is intensive and sustained and supported by modeling, coaching, and collective problem-solving. Finally, it attempts to relate itself to other aspects of organizational change.

As a tool for the performance-centered approach and one of the viable alternatives for traditional professional development, an EPSS has been proposed for supporting the most critical activities of teachers, instructional design activities, i.e., curriculum development and lesson design. EPSS has been defined in various ways; however, there exist general agreements on the major goals of an EPSS. The goals are to: (1) provide "whatever is necessary to generate performance and learning at the moment of need," referred to as "just-in-time training systems" (Geber, 1991, p.34); (2) enable "day-one performance," the idea that novice users should be productive on the very first day that they start using a system (Gery, 1995); and (3) support higher levels of performance for the work being done today, while helping to build the knowledge infrastructure for work to be done in the future (Winslow & Bramer, 1994).

In the education field, there have been many electronic performance applications that meet or closely meet these common goals of EPSS although they are not always given the label "EPSS" (Collis & Verwijs, 1995). The applications include instructional material development tools, grade books, and behavioral management support systems. What are the differences between these electronic performance applications for teachers and E-EPSS? E-EPSS is an "integrated" support system that includes tools, expert systems, instructional activities, and databases that assist teachers "at the time and place they need the assistance." By supporting teacher practices at the moment of need, it helps teachers to improve their professional skills. The electronic performance applications, on the other hand, are single tools that support teachers in performing specific tasks. They are developed primarily as supplementary instructors, rather than as teacher professional development tools, that usually assist students' learning activities. In addition, they are based on traditional classroom practices that assume education is a delivery or transfer of knowledge (Chiero, 1996; Collis & Verwijs, 1995).

The recent advance of the Internet and other computer technology has created opportunities for teachers to use various Internet-based communication functions such as emails, distribution lists, and forums. Using these tools, teachers can now consult with experts in the areas where they have questions and share their knowledge and experiences with other teachers effectively and efficiently. Several examples of EPSSs that utilize such communication functions are currently available on the web. The STEPS web site available at <http://143.88.86.98/pacee/steps/welcome.cfm> (or at <http://www.ibinder.uwf.edu/steps/welcom.cfm>) is an EPSS designed specifically to help K-12 teachers to develop instructional lessons, units, and curricula. Another example, Pathways to School Improvement, available at <http://www.ncrel.org/sdrs/pathwayg.htm>, is designed primarily to assist high school teachers with their curriculum development.

### **E-EPSS Design**

Many design guidelines and strategies for general EPSS can be applied to the design of E-EPSS. However, in designing E-EPSS, special attention must be paid to reflecting teachers' unique professional characteristics onto the system. This section discusses design suggestions adopted from the general EPSS design literature.

### **Components of E-EPSS.**

Leighton (1997) synthesizes the ideas of Gery (1991, 1995) and Raybould (1990), and contends that an EPSS has four typical components: tools, an information base, an advisor, and learning experiences. Similarly, Carr (1992) explains that an EPSS can play the roles of a librarian, an advisor, and an instructor. Even though researchers name components of E-EPSS differently, their classifications have commonalities. Typically, an E-EPSS is composed of tools, a database, an expert system, and instructions (Gery, 1991; Raybould, 1990). The following list summarizes functions and examples of each component:

- Tools: Tools usually embody recommended procedures or best practices that should be employed by the user (Reeves, 1995). Examples of tools include word processing, spreadsheets, templates, and forms.
- Database: A dynamic EPSS includes an infobase and users supply much of its content. The shared base of user experiences grows over time, making the infobase increasingly valuable to organizations (Laffey, 1995). An infobase may contain on-line documents, reference material, case history data, etc.
- Expert system: An expert system usually provides two distinct types of support: proactive support and reactive support. Proactive support is usually delivered through a coach that provides assistance in setting goals and monitoring task completion. Reactive support is delivered through context-sensitive on-line help that assists users when they have reached an impasse and cannot proceed without overcoming a problem in using the software.
- Instructions: Instructions typically include Computer-Based Training (CBT), but not in a traditional form of CBT. Traditional CBT might employ a sequential approach in providing a four-hour course on instructional design process. Learning experiences within an EPSS, however, must be organized into capsules that contain five to fifteen minutes of instruction. The capsules typically deal with specific topics that can be accessed while tasks are being performed. Examples of instructions include multimedia, CBT, tutorials, simulations, and scenarios.

Depending on the scope and nature of an EPSS and technological platform, an EPSS is made up of a combination of at least one or more of these four components.

### **Interface Design of E-EPSS.**

User interface is the single most important element of a successful electronic performance support system (Gery, 1995; Cole, Fisher & Saltzman, 1997). It is important to design the interface of an E-EPSS in a way that will support teachers' performance (Law, Okey, & Carter, 1995). To do so, designers need to consider teachers' mental models about teaching (i.e., what teachers think about instruction), workflow, and daily activities. The interface that follows teachers' natural workflow using screen metaphors that are familiar to them, facilitates understanding of the functions of an EPSS and accordingly reduces time needed for training. Hansen and Perry (1993) argue that long-term success of a system depends on teachers' degree of comfort and confidence in using a system.

As ways to capture teachers' mental models, Law et al. (1995) suggest the case-based reasoning approach through which one can analyze complex problems. They also recommend conducting a task analysis to determine what task components a product should include and how each component contributes to the overall product. To identify necessary components to be included, it is necessary to analyze the actual daily-based tasks, the performance of these tasks, and the elements that can alter each task (Moore, 1998). The analysis techniques of EPSS task analysis are similar to those of ISD (Witt & Wager, 1994). They include interviews, observations, questionnaires, and small-group discussions. EPSS task analysis, however, requires collecting data from both experts and novices, especially the data on their cognitive work processes, unique professional demands, and job-specific situations (Villachica & Stone, 1999; Stevens & Stevens, 1995). In other words, the components and content of an EPSS for teachers need to reflect teachers' unique workload in different types of schools – kindergarten, elementary school, and secondary school. Orey, Moore, Hardy, and Serrano (1997) report that middle school teachers spend an average of 31.6 minutes per day preparing resources and 49.4 minutes per day planning lessons. Depending on types of school categories of teachers' workloads and proportion of time, time breakdown is somewhat different. However, they are similar in that deskwork (i.e., grading) consumes a large portion of the teachers' office time.

The structure of an EPSS should be easy to use, flexible, and tailored for end-users having different needs and different expertise (Hansen & Perry, 1993; Remmers, 1998). A solution to accommodate different levels of competency of teachers is not to make all information directly visible, but to make it accessible, for instance by search tools that enable end users to find precisely the information they need (Sherry & Wilson, cited in Remmers,

1998). The structure of an EPSS must be customizable for the needs of different districts, schools, and teachers. In addition, cognitive loads and relational maps can be considered in design.

Raybould (cited in Gery, 1991) suggests six effective screen structures for different information maps: single frame, tree, network, linear format, rule, and animation. The Yale Style Manual (1999) introduces structures of Web-based EPSS that include sequence, grid, hierarchy, web structure, and empirical structure. Since each structure has its own strengths and needs, the developer can choose the system which best matches the prospective users' characteristics. For example, empirical structure is an effective way to organize a less-abstract view of the content when the users are novices in the field (Remmers, 1998).

Carroll's (1998) study on text interface led to the design of minimal manuals that drastically cut verbiage, encourage active involvement with hands on experiences as soon as possible, and promote guided exploration of system features. According to Paivio (1990, 1991), clear texts or images only are better sometimes than unclear texts with images and vice versa. To employ graphics in the design of EPSS, it is necessary to understand how graphics and other media (e.g., texts, audio, and videos) are cognitively processed and affect learning. The dual coding theory by Paivio (1990, 1991) describes how graphics become associated with texts in space and time. It also describes ways to organize materials according to the students' previous experiences.

Lastly, an action-oriented interface should anchor tools in the corresponding task domains and support error recognition and recovery in addition to the users' performance.

## **Usability Evaluation**

Amidst the rise of the user-centered design principle, many system design institutions have realized the importance of usability evaluation and are practicing it as an ongoing system design and development process.

The formal definition of usability written by International Standards Organization (ISO, 9241-11) is "the effectiveness, efficiency, and satisfaction with which specified users achieve specified goals in a particular environment" (Bevan & Macleod, 1994, p.135). Bevan and Macleod explain that this definition characterizes usability as a "quality of use that can be measured as the outcome of interaction in a context" (p.135). What they mean by this is that the overall system context is composed of users, their goals (or tasks), and the physical and organizational environment, as well as the system itself. The quality of use is indicated by the degree of effectiveness, efficiency, and satisfaction as experienced in the result of the interaction among the four system components. The first two usability indicators, effectiveness and efficiency, are usually assessed by collecting behavioral performance measures in regard to learnability, efficiency, productivity, memorability, and number of errors (Nielsen, 1993). Satisfaction, on the other hand, is usually assessed by examining users' perceptions about the system.

Perceptions affect every aspect of the system, including usability. It is not rare to hear from users that they think a certain system is usable when they actually failed to perform tasks using the system. The reverse is often heard, too. This discrepancy between actual performance and perceptions has not been often researched in the field of usability evaluation. Traditionally, usability studies tended to collect only performance measures and determine a system's overall usability based on them. Even worse, they tended to disregard users' perceptions as invalid usability data.

Studies such as those by Bailey (1995), Tractinsky (1997), and Morris and Dillon (1997), however, began to address the discrepancy between performance and perceptions and to emphasize the importance of assessing perceptions. Since this kind of study is relatively new to the usability field, there is no standardized term to refer to the concept of perceptions. Words such as "preference" (Bailey 1995), "apparent usability" (Tractinsky, 1997), and "impression" (Morris & Dillon, 1997) are used interchangeably with "perceptions." According to Tractinsky (1997), people formulate preferences for one system over the other on the basis of their vague beliefs about which interface would provide the fastest performance or apparent usability that they perceive from the aesthetics of the system. The preferred system, however, does not always result in better user performance or actual usability. In their study on Netscape, Morris and Dillon (1997) conclude that users' initial perceptions of Netscape's usefulness and ease of use significantly influence their attitude toward using Netscape as well as their intention to use it. The implication of these studies is that we need to treat performance and perceptions separately. They also tell us that we should examine users' perceptions of the system's usability as well as their behavioral performance while using the system, to measure overall usability accurately.

## **Evaluation Methodology**

### **Perception-Based Usability Evaluation**

In this study, we used a perception-based usability evaluation method. An EPSS like STEPS was a relatively new idea to the education community, so we were interested in investigating whether target users of STEPS liked the system and perceived it to be usable. In addition, STEPS was still under construction at the time of the evaluation so collecting performance data at that stage did not seem to be meaningful.

This evaluation elicited participants' perceptions of three aspects of the STEPS web site: usability of the six main menus, existence of necessary EPSS components, and effectiveness of nine main menu icons. The STEPS web site consisted of nine main menus and six of them were primary components of the site. The six menus included Main Menu, Lesson Architect, Best Practice, Sample Unit, Web Links, and Tutorial Library. The matter of our primary concern was to evaluate whether the participants perceived the six menus to be effective, efficient, and satisfactory (i.e., usable.) In addition, we were interested in assessing whether the participants perceived that STEPS contained all the necessary features of an EPSS. As described in the literature review section, an EPSS typically contains four basic components: tools, database, expert system, and instructions. Lastly, we wanted to evaluate the effectiveness of icons associated with the nine main menus. On the main page, each main menu was represented through the combination of an icon and a textual link underneath. Our concern regarded whether or not the icons matched the textual links, representing the content of their corresponding pages well.

### **Data Collection Methods**

Evaluation instruments included a usability questionnaire, a components questionnaire, a matching worksheet, observations, and structured interviews. The usability questionnaire (See Appendix A) aimed to measure the participants' perceptions of the usability of the six main menus. It consisted of yes-no answer items such as, "Are the page contents useful for intended users?" "Are the navigation icons or texts consistent?" and "Do you like using this system?" We used one questionnaire for each of the six main menus. The components questionnaire aimed to measure participants' perceptions of whether the STEPS website contained all the necessary EPSS components or not (See Appendix B). It consisted of questions like, "Does this EPSS have tools (e.g., templates, forms, word processor, spreadsheets) for facilitating teacher performance?" The matching worksheet (See Appendix C) assessed whether participants could match the main menu graphics with textual links correctly. We provided participants with a list of icons and texts and asked them to match corresponding icon and text. While the participants were exploring the site and responding to the questionnaires and the matching worksheet, observations were made to collect participants' reactions such as expressions of their frustration. The structured interviews (See Appendix D) at the end of the evaluation aimed to triangulate data from the questionnaires and observations.

To ensure the trustworthiness of the evaluation, we employed triangulation and member-checking procedures. This evaluation used three kinds of triangulation techniques: (1) data triangulation through the use of multiple data sources (e.g., questionnaires, observations, and interviews), (2) participant triangulation by asking individuals with diverse backgrounds to evaluate the website (e.g., elementary school teachers, instructional designers, and professors), and (3) method triangulation through the use of various data collection methods (e.g., questionnaires, observations, matching worksheets, and interviews). After analyzing observation and interview data, we summarized the participants' opinions and then asked the participants to review the summaries. The aim was to ensure that the data analysis results matched their original opinion.

### **Participants**

Five participants engaged in the evaluation. Virzi (1992) conducted experiments regarding sample size for usability studies and concluded that observing four or five participants will allow a practitioner to discover 80% of a product's usability problems and observing additional participants will reveal increasingly fewer new usability problems. In addition, it is well known in the qualitative case study literature that there is a certain point after which discovery of new findings reaches saturation.

The target users of the STEPS website were K-12 teachers. Therefore, we invited people who had teaching backgrounds to participate; three of them have taught in K-12 settings and two have worked as teacher educators. We also invited people who had expertise in design and development of computer-assisted instructional systems, in addition to teaching experience. The purpose was to gather expert opinion on the design of the website. Appendix E summarizes profiles of the participants.

### **Evaluation Procedures**

The evaluation took place in the most typical computing environment of each participant. Some participants did computing at home and others worked at the computer labs provided by their university. All

participants used LAN Internet connection provided by the university. They used an IBM compatible PC or a notebook that had 24 RAM or more memory, Pentium 133 or faster processor, and 12- or 14-inch monitors.

At the beginning of the evaluation, the participants filled out a Demographic Information questionnaire (See Appendix F.) Then they were given instructions about how to conduct the evaluation. They were instructed to express any criticism frankly, use a think-aloud technique, and feel free to ask any questions about the evaluation procedures. It was particularly emphasized that if they were having difficulties in using the website it was not their fault but the fault of the website's ineffective design. When the participants felt comfortable about beginning the evaluation, we opened up the home page of the STEPS website and introduced the site's general purpose. Then, the participants were given six usability questionnaires, a components questionnaire, and a matching worksheet. They were requested to complete the questionnaires and the matching worksheet while exploring the site. Different participants looked at different levels of instruction since the entire STEPS website was too big for one person to explore in a given period of time. However, the evaluation criteria and scope were the same for all participants. Participant A explored the K3-5 level, participant B the K6-8, participant C the K9-12, participant D the K3-5, and participant E the K3-5. The participants thought out loud while exploring the site and we took notes of their comments. We sometimes asked probing questions if they did not verbalize problems voluntarily. When they finished all the questionnaires and the worksheet, a structured interview was conducted.

## Evaluation Results

Results were derived from three evaluations: 1) evaluation of the six main menus' usability using questionnaires, observations, and interviews; 2) evaluation of the EPSS components using a questionnaire; and 3) evaluation of the match between icons and texts using a matching worksheet.

### Usability of six main menus

The usability questionnaires asked for participants' perception regarding each menu's effectiveness, efficiency, and appeal. Table 1 summarizes percentages of positive (i.e., yes) responses.

*Table 1. Percentage of positive responses in six usability questionnaires*

	Best Practice	Sample Unit	Web Links	Tutorial Library	Lesson Architect	Main Menu
<b>Effectiveness</b>						
Are the page contents useful for intended users?	100	100	80	60	20	0
Do you believe this site can facilitate teacher performance?	100	80	60	60	40	0
Mean	100	90	70	60	30	0
<b>Efficiency</b>						
Are the navigation icons or texts consistent?	80	60	0	0	20	0
Is it easy to navigate back and forth?	80	80	0	100	0	0
Is the screen design user-friendly? (e.g., letter size, color, graphics, etc.)	80	60	20	20	20	0
Is the information concise?	80	40	40	20	20	20
Are the sentences easy to understand?	80	100	100	100	100	20
Mean	80	60	35	48	32	8
<b>Appeal</b>						
Are you interested in this EPSS?	100	60	60	60	20	0
Do you like using this system?	100	60	60	60	40	0
Mean	100	60	60	60	30	0

In the effectiveness evaluation, participants responded most positively to Best Practice. Sample Unit was second at 90%, followed by Web Links, Tutorial Library, Lesson Architect, and Main Menu. In the efficiency test, Best Practice was rated to be the most positive followed by Sample Unit, Tutorial Library, Web Links, and Lesson Architect, with Main Menu receiving the least positive evaluation. In the appeal evaluation, Best Practice received the most positive responses, followed by Sample Unit, Web Links, Tutorial, Lesson Architect, and Main Menu.

Overall, the participants responded to the three criteria in a similar pattern. They favored Best Practice the most and Main Menu the least for all three criteria.

The results from the interviews were congruent with those of the questionnaires. Most participants made positive comments on Best Practice, including “menus organized by subject makes it easy to grasp the content,” “it provides examples of specific objectives,” “table structure of the menu makes it easy to navigate,” “color change gives the indications of where I am,” and “it provides concise information with graphics and animations.” For Sample Unit, participants made both positive and negative comments. On the other hand, participants responded more negatively to Main Menu and Lesson Architect. For Main Menu, in particular, five participants expressed similar concerns such as “the location of buttons is inconsistent so navigation is not easy,” and “after clicking, there is no consistency in screen display.” For Lesson Architect, participants responded negatively, making comments such as, “it’s hard to know the function of icon-only buttons,” “there is no direction after clicking,” “too much scrolling to do,” and “data are not organized so it’s not easy to find needed information.”

### **EPSS components**

Most participants identified STEPS as a system that contained database and tool components more than instruction or expert system components. All participants agreed that STEPS contained database, 80% agreed it contained tools, 40% instruction, and 20% expert system. They pointed out that Lesson Architect was a template embedded with word processing functions. They commented that, using Lesson Architect, a teacher could develop and save instructional designs and curriculum plans with the help of instructional theories such as Gange’s Event of Instruction. Web Links included links to numerous web sites. Best Practice was a database of effective classroom activities.

Although participants did not recognize it clearly, STEPS did include expert system and instruction components. Ask Coach and Tutorial Library were representations of the components. Ask Coach provided field-sensitive help in a pop-up window; however, most participants stated that the help was not informative or useful for actual instructional activities. The fact that Ask Coach was still under construction might have been the cause of this response. Also, most users thought that it is very limited in that it only provides fixed explanations and cannot make a relational query within the Coach or support customized help depending on users’ level of competence. As for the Tutorial Library, participants responded that the information was not useful for specific design activities.

### **Match between icon and text**

None of the participants matched more than four of the nine pairs. Evaluator A matched 3 pairs, evaluator B matched 2, Evaluator C, 1, Evaluator D, 4, and Evaluator E, 3. The difficulties in matching icons with texts were caused mainly by the inadequacy of icons in portraying corresponding textual information. In addition, the way line spacing was used made it difficult for participants to know which icon corresponded with which text.

### **Overall comments**

The participants agreed unanimously that an EPSS like STEPS was a powerful tool for effective instruction. However, they said that STEPS should go beyond being an electronic book. They commented that it should facilitate interaction between teachers and provide guidelines, not just information. They thought teachers would be able to enhance their performance with the help of such interaction and guidelines.

### **Recommendations for Designing an E-EPSS Effectively**

Based upon our evaluation results and literature reviews on E-EPSS design, we recommend the following heuristics for effective E-EPSS design.

#### **Design an interface that supports teacher performance**

Participants did not think that Main Menu and Lesson Architect facilitated teacher performance. This response is critical in the case of Lesson Architect especially, because Lesson Architect is supposed to facilitate teacher performance by helping teachers to build lesson plans. Laffey (1995) asserts that current models of EPSSs provide the kinds of resources needed but do not support the processes by which these resources are used or

customized for the work environment. Instead of seeing an EPSS as merely a vehicle for delivering information, we need to see it as a re-conceptualization of the work environment.

### **Provide context specific information**

Participants thought STEPS lacked expert system functions and particularly context - or subject-specific guidelines. Evaluator B, for example, responded, "STEPS looks like a teacher guidebook but its information is too general, not subject-specific." She recommended that the Language Arts section should contain more specific information to be useful in actual instructional design activities.

The process of determining the content of an E-EPSS should involve a thorough examination of related literature and consultation with subject matter experts, teachers, and teacher educators. It should also include identification of teachers' daily activities such as lesson planning and instruction design. Once the activities are identified, the designer needs to specify possible questions teachers could ask at each stage of the activity, and provide necessary supports that will answer the questions. This kind of support must be updated and expanded when necessary.

### **Provide structured navigational schemes**

The evaluation results show that people like structured navigational scheme such as menus organized by subject in a table format. To provide a structured navigational scheme, it is important to build a "bird's-eye view" into the design. Users should be informed about where they are now and where they should go next. In STEPS, the hierarchy and relationships among different levels (corporation level, unit level, and lesson level) are not indicated clearly, resulting in confusion in navigation.

The Object Action Interface (OAI) model by Shneiderman (1998) is useful for designing a structured interface. It guides system designers to view interfaces in terms of the tasks that the interfaces will carry out. By matching interfaces with tasks, designers can produce task-oriented and structured interface designs.

### **Consider the level of students the users teach**

Participants mentioned that content in STEPS should consider grade levels. If the content is for elementary teachers, for example, it should reflect perspectives and difficulty levels appropriate for elementary students. In this way, the teachers will be able more easily to relate what they get through STEPS to their students' learning activities. Rummery (1998) contends that the structure of an EPSS should be easy to use, flexible, and tailored for end-users with different needs and expertise.

### **Provide interactive screen designs**

Participants made comments such as, "it's more like a technical report," "texts are not easy to read," "the content seems like texts from a book," and "I need to do too much scrolling and get lost often." These comments tell us that STEPS could be perceived as an electronic page-turner. To prevent this perception, STEPS needs to incorporate action-oriented design approaches such as anchoring tools in the task domain and supporting error recognition and recovery, and user performance.

### **Limitation of study**

Although we referred to a published article by the STEPS developers, Northrup and Pilcher (1998), we did not have access to enough of the developers' opinions regarding their intentions about STEPS development and the purpose of the program. In addition, we did not have any information about their development processes such as difficulties in the processes and timelines of their development and implementation.

The evaluation materials that we developed for this study are the results of our research on usability and educational evaluation studies. Although we hope the materials helped us measure participants' perceptions accurately, we think the materials need to be subjected to quality examination such as reliability and validity tests.

It should be noted that the questionnaires measured participants' subjective perceptions of the program. Objective performance measures such as time taken to finish certain tasks or error rate were not collected in this study. A future evaluation study that collects performance data will provide us with a richer picture of the program's usability and educational value.



## References

- Bailey, R. W. (1995). Performance vs. preference. Proceedings of the Human Factors Society Annual Conference: HFES, 316-320.
- Barker, P., & Benerji, A. (1995). Designing electronic performance support systems. *Innovations in Education and Training International*, 32(1), 4-12.
- Bevan, N. and Macloed, M. (1994). Usability measurement in context. *Behavior & Information Technology*, 13(1&2), 132-145.
- Carr, C. (1992). PSS! Help When You Need It. *Training and Development*, 46(6), 30-38.
- Carroll, J. M. (1998). *Minimalism beyond the Nurnberg funnel*. Cambridge, MA: MIT Press.
- Chiero, R. T. (1996). Electronic performance support systems: A new opportunity to enhance teacher effectiveness? *Action in Teacher Education*, 17(4), 37-44.
- Cole, K., Fisher, O., & Saltzman, P. (1997, July). Just-in-time knowledge delivery. *Communications of ACM*, 49-53.
- Collis, B. A., & Verwijs, C. (1995, January-February). A human approach to electronic performance and learning support systems: Hybrid EPSSs. *Educational Technology*, 5-21.
- Dick, W., & Carey, L. (1996). *The systematic design of instruction*. New York: Harper-Collins Publishers.
- Gagne, R. M., Briggs, L. J., & Wager, W. W. (1992). *Principles of instructional design*. Orlando, FL: Harcourt Brace Jovanovich College Publishers.
- Geber, B. (1991, December). Help! The rise of performance support systems. *Training*, 23-28.
- Gery, G. J. (1991). Electronic performance support systems: How and why to remake the workplace through the strategic application of technology. Boston, MA: Weingarten.
- Gery, G. J. (1995). The Future of EPSS. *Innovations in Education and Training International*, 32(1), 70-73.
- Gustafson, K. L. (1993). Instructional design fundamentals: Clouds on the horizon. *Educational Technology*, 33(2), 28-32.
- Hasen, E., & Perry, D. (1993, November). Barriers to collaborative performance support systems in higher education. *Educational Technology*, 46-52.
- Laffey, J. (1995). Dynamism in electronic performance support systems. *Performance Improvement Quarterly*, 8(1), 31-46.
- Law, M. P., Okey, J. R., & Carter, B. J. (1995). Developing electronic performance support systems for professionals. *Proceedings of the Annual National Convention of the Association for Educational Communications and Technology*.
- Leighton, C. (1997). *What is an EPSS?* [On-Line]. Available: <http://itech1.coe.uga.edu/EPSS/whatis.html>
- Moore, J. L. V. (1998). *The implementation of an electronic performance support system for teachers: An examination of usage, performance, and attitudes: Middle school teachers, planning, assessment, student's progress reports*. Unpublished doctoral dissertation, University of Georgia.
- Morris, M. and Dillon, A. (1997). How user perceptions influence software use. *IEEE Software*, 14(4), 58-65.
- Nielsen, J. (1993). *Usability engineering*. San Francisco: Morgan Kaufmann Publishers.
- Nielsen, J. (1996). *Top Ten Mistakes in Web Design*. [On-line]. Available: <http://www.useit.com/alertbox/9605.html>
- Norman, D. (1988). *The Psychology of Everyday Things*. New York: Basic Books.
- Northrup, P. T., & Pilcher, J. K. (1998). STEPS: An EPSS tool for instructional planning. *Proceedings of Selected Research and Development for Educational Communication and Technology*.
- Orey, M., Moore, J., Hardy, J., & Serrano, R. (1997). *Designing an electronic performance support tool for teachers*. [On-line]. Available: <http://lpsll.coe.uga.edu/publications/eera-epss/t-tools-eera.html>
- Paivio, A. (1990). *Mental representations: A dual coding approach*. New York: Oxford press.
- Paivio, A. (1991). Dual coding theory: retrospect and current status. *Canadian Journal of Psychology*, 45(3), 255-287.
- Raybould, B. (1990). Solving human performance problems with computers. *Performance & Instruction*, 29(11), 4-14.
- Reeves, R. C. (1995). *Do you need an EPSS?* [On-line]. Available: <http://it2.coe.uga.edu/EPSS/Need.html>
- Reigeluth, C. M. (1999). What is instructional-design theory and how is it changing? In C. M. Reigeluth (Ed.). *Instructional-design theories and models*, Vol II. (pp. 5-29). Mahwah, NJ: Lawrence Erlbaum Associates.
- Rummers, E. (1998). *Guidelines for WWW-based support environments for education professionals*. [On-line]. Available: <http://how.to/designwebepss>

Scales, G. R. (1994). Trends in instructional technology: Educational reform and electronic performance support systems. *Proceedings of Selected Research and Development Presentations at the National Convention of the Associations for Educational Communications and Technology*.

Shneiderman, B (1998). *Designing the User Interface: Strategies for effective human-computer interaction*. Addison-Wesley.

Stevens, G. H., & Stevens, E. F. (1995). Designing EPSS tools: Talent requirements. *Performance & Instruction*, 34(2), 9-11.

Tractinsky, N. (1997). Aesthetics and apparent usability: Empirically assessing cultural and methodological issues. *Proceedings of the Annual ACM SIGCHI Conference: CHI'97*. New York: ACM Press. 115-121.

Villachica, S. W., & Stone, D. L. (1999). Performance support systems. In H. D. Stolovitch, & E. J. Keeps (Eds.). *Handbook of human performance technology: Improving individual and organizational performance worldwide*, (pp. 442-463). San Francisco, CA: Jossey-Bass.

Virzi, R. A. (1992). Refining the test phase of usability evaluation: How many subjects is enough? *Human Factors*, 34, 443-451.

Winslow, C. & Bramer, W. (1994). *Future work: Putting knowledge to work in the knowledge economy*. New York: The Free Press.

Witt, C., & Wager, W. (1994). A comparison of instructional systems design and electronic performance support systems design. *Educational Technology*, 34(6), 20-24.

Yale Style Manual. (1999). *Yale style manual*. [On-line]. Available:  
<http://info.med.yale.edu/caim/manual/interface/navigation.html>

# **Integrating Educational Technology into Field Experiences and Teacher Education Curriculum-A Systemic Approach**

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## **Abstract**

*Field experience is a crucial stage for prospective teachers. However, evidence shows that there are only twenty percent of teachers in the nation feel well prepared to integrate educational technology into classroom instruction (1999, Year 2 StaR Report). As a result, the prospective teachers may not observe classroom teachers integrating educational technology during field experiences. This presents a severe deficiency in the teacher preparation process. This project is about systemically integrating educational technology into field experience and the Teacher Preparation curriculum. Through consultation and training, cooperating teachers work with prospective teachers to implement educational technology into field experiences, while faculty members in the Teacher Preparation Program and the Arts and Sciences Departments set role models in the methods courses and regular curriculum. Systemic growth and collaboration will sustain in the participating schools and the teacher education institution.*

## **Need for the Project**

Field experience and student teaching are two crucial stages for prospective teachers before they become regular classroom teachers. They take methods courses in the teacher education program that prepare them in concepts regarding how a classroom is constructed and how learning and teaching are developed in the classroom context. It is not until the field experience that the prospective teachers often realize the real work of teaching from a teacher's point of view. They observe and depend on the cooperating teachers to provide the models and to demonstrate how learning and teaching can take place effectively in the classroom. Based on CEO Forum Reports (1999, Year 2 StaR Report), only 20 percent of teachers in the nation feel well prepared to integrate educational technology into classroom instruction. This means that, when prospective teachers go into the field, the chances are that they may not observe classroom teachers integrating educational technology, depending on whether or not their cooperating teachers are among that 20 percent of teachers. Given the national awareness of how technology should be integrated as a powerful learning and instructional tool in the classroom (NCATE, ISTE Standards), this statistic reminds us that there is a severe deficiency in teacher preparation programs. No matter what kind of technology training and method courses we equip our prospective teachers with in the teacher preparation curriculum, they may or may not be able to see how educational technology is being used in real classrooms during field experience.

The Teacher Education Program at a reputable private university located in north central Ohio requires prospective teacher to take at least two courses in educational technology. The course content includes skills in using different traditional and non-traditional technology, theories about why and how educational technology should be integrated to enhance learning and instruction, and examples of integration. However, if the field experience does not ensure the perspective teacher an appropriate context, the training and knowledge the perspective teacher received from the program cannot be validated and reinforced in real classrooms.

The Teacher Education Program and the College of Education at this university are among the largest in the state of Ohio. The university sends out over 500 students for field experiences every semester and works with 23 school districts (103 school buildings) including over 350 cooperating teachers. Based on the survey delivered to these cooperating teachers who work with this university, there are only 25 percent of the teachers who feel confident in integrating technology in the regular curriculum. With these figures in mind, we wonder how many of our children in the classrooms missed out on the opportunities to use technology as a powerful learning tool and are being under-prepared for the digital era.

Another area that presents a problem is the low percentage of educational technology integration in courses that prospective teachers take from the Arts and Science Department (30%) and the Teacher Education Program (35%) at this university. Not all faculty members who teach these courses have the knowledge and skills to model the integration of technology into curriculum as inquiry and instructional tools. As a result, the prospective teachers face double jeopardy. Not only can't they see much modeling from their cooperating teachers during field experiences, neither do they see much modeling within their teacher preparation curriculum with the exception of the two educational technology courses.

To correct the deficiency of the teacher preparation process, a systemic approach is in order. This approach entails a partnership among the stakeholders including the Teacher Education Program, institutions that host the program, faculty members in the Teacher Education Program and the Arts and Science Department, public schools administrators, classroom teachers, prospective teachers, and community members. With the understanding that the partners involved in this project will have far more impact than the initial scope of this project, the next section will explain the design by which this partnership improves and eventually resolves the aforementioned problems.

## **Design of the Project**

### **A. Goal and Expected Outcomes**

The goal of this project is to systemically improve the field experiences of the Teacher Education Program and the degree to which cooperating public schools and the university faculty members integrate educational technology (ET) into regular curriculum. The expected outcomes include but are not limited to the following:

- Increased degree of educational technology integration in field experiences for the prospective teachers at the university.
- Increased confidence of prospective teachers in integrating educational technology in the classroom settings.
- Increased skills and knowledge of prospective teachers in integrating educational technology in the classroom settings.
- Increased degree of educational technology integration in participating public schools.
- Increased degree of educational technology integration in the Teacher Education Program and Arts and Science Department in the university.
- Increased confidence levels for participating professors in the use and integration of educational technology in the content courses.
- Increased confidence levels for participating cooperating teachers to sustain the interest and the skill of educational technology integration.
- Increased collaboration among teachers and prospective teachers in educational technology integration.
- A consortium Web site will be built for this project so that all participants can use the collective information (i.e., lesson plans, integration ideas, published student works, etc) and collaborate their efforts. This Web site will be designed in ways that can accommodate people with disabilities.
- A documentary videotape will be made to share the successful experiences and preliminary model with other universities and k-12 schools.

### **B. Description of the Project Design**

This partnership will be developed in the following four stages -preparation: commitment of partners; assessment and training; adaptation; summative evaluation and diffusion. Formative evaluations will be conducted in each stage to evaluate the effectiveness of the process. A consortium Web site will be built to contain the information of this project. A videotape will be produced documenting the entire process to be used in the diffusion stage of the project.

#### **Stage I: Preparation-Commitment of Partners**

##### **Time Frame: Pre-Project Time**

In the first stage of the partnership, each partner will need to commit to the shared vision and provide the necessary resource (i.e., service, time, money, equipment, etc) to facilitate this partnership. The shared vision is to systemically improve the quality of field experience of the Teacher Education Program, the quality of teacher preparation curriculum, and the competency of classroom teachers in the area of educational technology integration, in turn to produce competent teachers and richer educational experience in the classrooms. The partners in this project include the Teacher Education Program at the university; the Educational Technology Program in the university; 6 school districts; faculty members in the Teacher Education program; faculty members in the Educational Technology program; faculty members in the Arts and Science Department who teach methods courses

to prospective teachers; cooperating classroom teachers from 6 school districts; and prospective teachers who are enrolled in the teacher education program at the university.

Examples of commitment include but are not limited to the following:

1. Participating school districts will raise 3% of the budget in the area of educational technology.
2. Participating school districts have to continue to support the existing in-service training in the area of technology integration.
3. Public schools administrators will commit to obtaining video conferencing facilities (i.e., cable TV, Polycom unit, or Satellite dish) for cooperating teachers to receive consultation at their school sites.
4. Educational technology faculty members in the Teacher Education Program will be given released time and incentives to offer training to faculty members in the Teacher Education Program and methods teachers in Arts and Science Department.
5. The university will have a video conferencing facility and video capturing and editing equipment for the Teacher Education Program since these are the areas that have not been covered in the curriculum due to the lack of facilities. In addition to necessary on-site consultation, educational technology faculty members and selected professionals will need this facility to deliver consultation to classroom teachers in different school districts.
6. Faculty members in the Teacher Education Program and faculty members in the Arts and Science Department who teach methods courses will commit to receive training or consultation in the area of educational technology integration.
7. Participating school teachers who are skilled in the area of educational technology are given incentives to coach peer teachers or to conduct in-service training
8. Although not as official members in this consortium, educational technology professionals from the Tri-County Computer Service Association (TCCSA) and Tri-River Educational Computing Association (TRECA) will be contracted to provide consultation to the cooperating teachers and prospective teachers either on-site or via video conferencing facilities regarding how to integrate educational technology during the field experience sessions.
9. Prospective teachers who have taken educational technology courses in the university will assist the cooperating teachers in needed technology skills while working with consultants to integrate educational technology into field experiences.
10. Classroom teachers who receive consultation as a result of this partnership will provide consultations to their peer teachers given limited incentives.

## **Stage II: Assessment and Training**

**Time Frame: First Project Year (June,1, 2001-May 31, 2002)**

In the second stage, the focus of this project is to identify the areas where the faculty members in the Teacher Education Program and the Arts and Science faculty members who teach methods courses lack knowledge and skills, and provide training that is needed. The areas where cooperating classroom teachers need consultation from the trainers are also identified during this stage.

Based on the national standards (ISTE), the contents of training and consultation sessions for participating university faculty members, cooperating teachers, and prospective teachers would include but not be limited to the following:

- Basic concepts and skills of using computer systems
- Basic concepts and skills of using computer related peripherals, i.e., scanner, digital camera, projectors, etc)
- Using productivity tool (word processor, spreadsheet, database) effectively as teaching, learning, and management tools.

### Examples

- Proficient use of word processor to produce document for specific purpose, such as newsletter, communication, and professional documents.
- Power point presentation– Instructional tool (teacher), learning tool (students)
- Spreadsheet application-inquiry project, grading sheets, etc.
- Database-inquiry project, resource management, test bank, etc.

- Using Hypermedia tools such as Hyper Studio and KidPix as instructional and learning tools. Examples: tailored tutorial, drill and practice for specific topic & students; student created projects for specific topics under study.
- Using Internet applications for research, communication, instruction, learning, and management.

Examples:

- Advanced email communication and listserv
- Locate and utilize resource database
- Develop Web pages that include instructional element (tutorial, information), learning element (research project, collaborative learning projects), management element (class Web site, syllabus, and communication with students and parents).
- Be able to search useful Web sites and create annotated list of good software and useful sites to share with colleagues.
- Be able to provide description of criteria for selecting and evaluating educational software.
- Be able to provide a written guide and example of using Web sites and software for inquiry projects.
- Using existing assistive technology features for inclusion classrooms.
- Using video conferencing facilities to communicate and to collaborate.

A needs assessment will be conducted to identify the gap between the desired training outcomes and the current skill and knowledge of the participating university faculty members. After the needs are identified, the university faculty members need to commit to signing on for training sessions so that they can model the use of technology in the context of their subject matters.

The Educational technology faculty members in the university and selected professionals will provide training to the participating faculty members either on sites or via video conferencing. Similar needs assessment will be conducted for participating cooperating teachers. With the pre-existing in-service training that individual participating school offers, the trainers will consult and scaffold cooperating teachers and prospective teachers to integrate educational technology into field experience sessions. The classroom teachers will be informed of the schedule when the skill sessions will be provided for university faculty members. The cooperating teachers are welcomed to join the sessions via video conferencing facilities or on site where the facilities permit.

Knowing the cooperating teachers and prospective teachers have integrated educational technology into field experiences, faculty members who teach educational technology courses in Teacher Education Program will incorporate the field experience sessions into the courses using video conferencing facilities. With permission from the administrators and cooperating teachers, the field experiences sessions can also be videotaped and later shown as examples for prospective teachers. The prospective teachers who have not engaged in field experiences will have the opportunity to see what is done in the classroom context. This can provide an authentic, real world, and motivating experience for the prospective teachers to learn how to use and to integrate educational technology in the classroom settings.

Surveys will be conducted to examine the effectiveness of each training session and consultation process. The training sessions for university faculty members can be videotaped for review by participating faculty members and for evaluation purposes. All participating classroom teachers, prospective teachers, and faculty members will be requested to provide reflection papers on their progress in integrating educational technology with provided guidelines throughout the year. Prospective teachers will continue to apply what they have learned and observed from field experience to their student teaching. They can even apply the consultation skills observed from the trainers to consult with their colleagues in the future. In addition to the reflection papers, participating classroom teachers also have to provide records on the noticeable change in students' performance and motivation for learning or any noticeable changes in other aspects of learning. Integration lessons and curriculum examples are collected. The collected examples will be put onto the consortium Web sites so that all the participants in this project can collaborate and share the information and integration ideas. These experiences will also be shared and demonstrated in the showcase conference.

Surveys will be conducted to evaluate specific aspects of the overall progress. The progress results will be tallied, documented, and analyzed by professional evaluation analysts.

### **Stage III: Adaptation**

**Time Frame: Second Year (June, 1, 2002-May 31, 2003)**

As a result of training sessions during the first year, more participating university faculty members are better prepared to model the integration of educational technology in different subject matters. Some of the faculty members can also assume leadership roles to offer training for their colleagues.

In the participating schools districts, some of the participating classroom teachers start to serve as consultants to their peers. Under the supervision and with the consultation of their trainers, these cooperating teachers can even conduct in-service training to their peer teachers. This process is to make these cooperating teachers feel confident in integrating educational technology into the classrooms and make public schools a natural place for collaboration and professional development.

The gap between prospective teachers and classroom teachers starts to diminish at this stage. A collaborative relationship is fully developed between prospective teachers and classroom teachers. Prospective teachers who go on to student teaching become proficient peers with their cooperating teachers. In the mean time, a new group of prospective teachers will work with the trained cooperating teachers and will have better field experiences since the cooperative teachers demonstrate the effective integration of educational technology into the classrooms. The TCCSA and TRECA professionals and educational technology faculty members will continue to consult a new group of cooperating teachers with a new group of prospective teachers to integrate technology into field experiences. The faculty members who teach educational technology courses in the Teacher Educational Program can incorporate the field experience session via video conferencing with the prospective teachers who have not yet engaged in field experiences. The cooperating classroom teachers can also serve as guest speakers in the courses to demonstrate and to motivate prospective teachers even before the prospective teachers start their field experiences.

Although the provision of training is still needed, half of the responsibility of the trainers shifts to consultation and scaffolding rather than conducting training to participating university faculty members. Participating public schools become more self-sufficient and continue to grow in the degrees of educational technology integration. More and more teachers are able to contribute to the collective growth of their schools in the area of technology integration. Less external training and consultation resources are needed for participating public schools.

Additional training areas are explored for participating university faculty members during this stage. The professional trainers and educational technology faculty members will provide new training topics depending on the new developments in educational technology and how the needs evolve.

Showcase conferences will be held annually. The participating university faculty members, cooperating teachers, and prospective teachers will share their experiences and progress in the conference. Evaluations of training sessions are conducted whenever training is offered. Throughout the year, all participating classroom teachers, prospective teachers and faculty members will submit progress reports and reflection papers based on provided guidelines. Educational technology integration lessons and curriculum examples are collected and put onto the consortium Web site. Classroom teachers continue to document the changes in students' performance and motivation for learning. Surveys will be conducted to evaluate specific aspects of the overall progress of this stage. The progress results will be tallied, documented, and analyzed by professional evaluation analysts.

#### **Stage IV: Summative Evaluation and Diffusion**

**Time Frame: The third year (June, 1 2003-May 31, 2004)**

While more and more faculty members and classroom teachers are being trained and become trainers, and prospective teachers continue to develop collaborative relationships with classroom teachers, the last stage of this project focuses on evaluating the project and diffusing the successful experiences of this project. The collected progress reports and reflection papers, classroom teachers' documentation on students' performance and motivation to learn, the evaluation of training sessions, the overall effectiveness and progress during each stage, and grant resource utilization are all systematically reviewed and tallied. Reports will be generated to illustrate the effects of this project. The Educational technology faculty members will offer a capstone course that focuses on evaluating the effectiveness of educational technology integration and will invite graduate students in educational technology to develop capstone experiences for the evaluation phase of this project.

The results of the project will be first shared with all partners in this project. As a whole, the partners will evaluate the effectiveness and efficiency of the project, the long-term benefits, and the future dissemination goals.

The results of this project will also be shared in major teacher educator conferences or educational technology oriented conferences such as ATE (Association for Teacher Educators), AECT (Association for Educational Communication and Technology), and NECC (National Educational Computing Conference). With the documentary videotape and consortium Web sites produced in this project, this project can serve as a model to help

other universities and public schools systemically improve teacher preparation programs and produce more competent classroom teachers in the area of educational technology integration.

### **Conclusion**

Enhancing the quality of teacher preparation programs in the area of educational technology integration is by no means an easy task. It entails systemic approaches to adjust the conditions of all the stakeholders to make the effort fruitful. The design of this project is one of the many endeavors undertaken by many educators and practitioners. The author believes that with the continuous effort, we will see the difference in the quality of our future teachers who ensure our children to be well prepared for the 21<sup>st</sup> Century.



## Student Technology Assistant Programs

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### Introduction

Schools face significant challenges in implementing computing technology within their curriculum. Federal funding programs such as e-Rate are helping schools surmount the first obstacle -- initial technology purchases. According to a recent article in *Electronic School*, the average school district now has 800 computers, or one for every 4.9 students (Kongshem, 2001). The National Center for Education Statistics reports that 98% of public schools are now connected to the Internet (Cattagni, 2001), and while this does not always mean individual classroom connections, it is nonetheless one of several strong indicators of the prevalence on technology in schools.. However, still remaining as formidable obstacles are the costs of maintaining this technology and providing training for its effective use. As Kongshem's *Electronic School* article points out, computers are no longer concentrated in computer labs. Increasingly, they are located in classrooms where technical support staff may have difficulty providing adequate support. Teachers are fast developing skills and strategies for integrating these classroom computers into the curriculum. As technology becomes a more powerful tool for delivering the curriculum, teachers are relying more and more on quick and reliable repair of their classroom computers.

In the business world, one full-time person has responsibility for maintaining 50-75 computers (Consortium for School Networking, 1999). In contrast, most school districts tend to provide one support person for every 500 computers. Typically in the business world one computer is used by a single user. But in the classroom, computers serve the needs, and suffer the abuses, of many users. It is no wonder that sometimes technology support in the schools falters.

And when technology support falters, the integrity of a school district's entire technology program is at risk. Teachers who have invested time to develop lesson plans using technology, especially those who are still newcomers, are less likely to continue to invest their energies if they cannot count on their computers to be up and running. When parents ask their children how computers are used in the classroom, or when parents visit the classroom, they may discern little or no technology use. These lapses may diminish the community support that is necessary for continuation or expansion of the district's technology program.

The purpose of this article is to describe how Student Technology Assistant (STA) programs can help schools, in particular rural school districts, solve some of these problems. Small rural school districts are less likely than large urban school districts to be able to purchase and implement the technology management solutions recommended for these new decentralized networks of computers. Instead, rural school districts like Plymouth (Wisconsin) School District are turning to creative programs where students help do the work: "It's not a formal program, but we recruit kids when they hang around and when we know they're interested. If a kid puts in a full class worth of time, we'll pay around five or six dollars an hour" (Kongshem, 2001). Sedgwick (Kansas) School District for several years has selected five top Computer Tech students to serve as Tech Apprentices, offering the students an elective credit for their participation. In an interview with HPR\*TEC's *KidSpeak* webzine, one Tech Apprentice noted, "If they just come in and hire a bunch of people, the people they hire don't go to school here everyday. They don't know the teachers. With students doing it... the teachers know us" (Brown, 2000). While the Plymouth and Sedgwick programs are fairly informal, many of the STA programs highlighted here are quite formal. All of them work by providing students with opportunities to gain credit for technical experience, at the same time providing technical and sometimes instructional or community-related services to others. In exchange for providing these experiences, the schools receive technical support, training for their teachers, and good communication with and support from the community for their efforts. The increased visibility and "buy-in" also give a boost to the adoption and diffusion of technology throughout the school.

One danger in implementing an STA program is that the educational needs of the students may become lost in the shuffle of administering the program. Before turning to specific programs, we'll examine this danger more closely. Then we'll define a successful STA program, discuss first steps in establishing such a program, point out a few operational considerations, and finally take a look at six successful models.

## Education First

At home, more and more school-aged children are gaining access to computers and the Internet. By August 2000, the percentage of homes with computers had risen to more than 50%. Household Internet access has also increased dramatically (NTIA, 2000). There is little doubt that computer access is becoming less of a problem while our students are coming into the classroom with more technical know-how each year.

Some headlines have called attention to the potential exploitation of these technology-savvy students as technology workers in their schools. Jamieson McKenzie, editor of the online education technology journal *From Now On*, draws similarities between some computer helpdesk tasks and mowing the school lawn or washing cafeteria dishes. "It's exploiting children," he says, "There are lots of jobs that need to be done, but we expect adults to do them" (Vail, 1999).

Similarly, some are concerned that students may have inappropriate access to data. A *Los Angeles Times* article reported that in 1997 members of a local California School Educators Association chapter filed a complaint with the Irvine School District because students had unsupervised access to "the most sensitive material we store: grades, personnel records, attendance, personal e-mail" (Huffstutter, 1998).

Advocates of STA programs note that several of the larger STA programs include carefully designed curricula that address ISTE's National Educational Technology Standards. Other programs incorporate coursework that leads to A+, Cisco, Microsoft, or Novell certification. Advocates stress that students should not be penalized for their technical knowledge. In the words of Dennis Harper, the director of Generation YES, "Schools must stop operating like factories, and start to work like modern companies. The kids are the ones in power because they have the knowledge. And if you can't trust your kids, you're in trouble" (Huffstutter, 1998). Michael Milone of *Technology and Learning Magazine* praises one STA program, SWAT, for its encouragement of students as stakeholders: "Students who participate in SWAT gain a sense that they are active participants in the education process and recognize that their contributions are valued, thus they develop a stronger sense of ownership of the process" (<http://www.iit.edu/~swat/overview.html>).

Perhaps the most often mentioned advantage of STA programs is that they give students marketable skills and real-world problem-solving experience. In the January 2001 cover story of *Electronic School*, "The New Networkers: The Path to Hot IT Jobs Begins in High School," Kevin Bushweller notes that according to recent industry projections "about 1.6 million new IT workers will be needed this year, but hiring managers predict that about 850,000 positions probably won't be filled by appropriately skilled workers."

To keep your program aligned with your school's educational goals, you may want to keep in mind the advice offered by Kathleen Vail in her article "Kids at Work: The Pros and Cons of Using Students as Technology Workers" (1999):

- Make sure the community knows what you're doing.
- Make sure the program has an educational element.
  - Offer class or internship credits
  - Allow students to work only during scheduled times
  - Balance a technology apprenticeship with apprenticeships in other careers
- Make sure the students are supervised and mentored.
- Keep the pressure off.
- Keep an eye on security.

## What are STA Programs?

Students have helped maintain computers since computers first entered schools in the 1970s. However, the start of formal large-scale STA programs can be traced to 1989 when Mike Bookey, a parent of a middle-school student in Issaquah (Washington) School District, agreed to help his daughter's school with a computer problem. Issaquah is home to many families who work for Microsoft and other high-tech companies. Yet the schools were, according to Bookey, like "a tribe cut off from the outside world for so long that they didn't know about telephones, voice mail, computers, e-mail, television, Internet and other tools of the information age" (<http://www.svi.org/connect96/Profiles/Issaquah.htm>). With the help of concerned educators, the support of taxpayers, and the volunteer time of many high-tech community members, Bookey started the TIP program (Technology Information Project). At Liberty High School in Issaquah, a small group of TIP students began meeting after school to learn about different network operating systems and to build prototype networks. TIP students and other volunteers did the "heavy work" of installing and troubleshooting equipment within the school district. A formal curriculum based on the TIP students' experience and modeled after similar corporate programs was put into

place in Issaquah in 1992 (<http://www.Issaquah.wednet.edu/district/technology.htm>). Issaquah's TIP program has since been replicated in other Washington districts, and many of the later STA programs drew inspiration from presentations which Issaquah students made around the country in the 1990s and through well-attended "open houses." TIP students worked as consultants for the State of Kentucky Department of Education in planning Kentucky's first STA conference in February 1995.

Issaquah, the community, is unlike most U.S. communities in its concentration of high-tech expertise and its taxpayer support of technology initiatives. In most of the programs discussed in this article, leadership for STA programs did not come from community members but instead from educators, and in some cases from the students themselves. For this article we've selected a range of programs, each with its own areas of emphasis. But in all of the cases discussed here, student technology assistants (STAs) are K-12 students who, under the leadership of their school, provide technological assistance to others. Usually, the assistance provided by such students is focused on instructional, technical or community-related activities. Students in such programs learn technology-related skills while providing a service to others. The work of STAs is often hailed as being beneficial for all involved.

### **Starting an STA Program**

Given the relatively inexpensive start-up and maintenance costs of an STA program, many schools are looking to start their own program. The logical question, then, is how to proceed. The following sections detail some ideas for starting your own STA.

### **Determining What Kind of STA Program You Want**

The first step is to determine what kind of STA program you want. The Educators' Technology Center of Indiana suggests that you begin by asking yourself who needs help and what kind of help are needed (<http://etc.iupui.edu/pyop.html>). Will your program focus solely on providing technical support to teachers and instructional computer equipment? This is one of the most common and cost-effective models for an STA program.

However, STA programs that address technical issues AND professional development can promote technology integration throughout the school and sometimes even save professional development costs. Such programs, however, require additional management and resources including, respectively, a coordinator for the program and monetary support from the school, district, and/or state. Such programs also do little to promote community awareness. Thus extra effort may be needed to publicize the good work the school is doing.

STA programs that combine all three types of service -- technical service, professional development, and community projects -- are generally the most beneficial (see Figure 1 for examples of the three types of service). The downside, of course, is that these programs require a significant commitment of resources in terms of management and coordination. Somebody has to serve as liaison to the community, evaluate possible projects, assign people to projects, monitor progress, and provide publicity in addition to generating the technical and professional development projects done in-house. There is no reason a school cannot begin with one type of program and expand as the school's needs and resources grow.

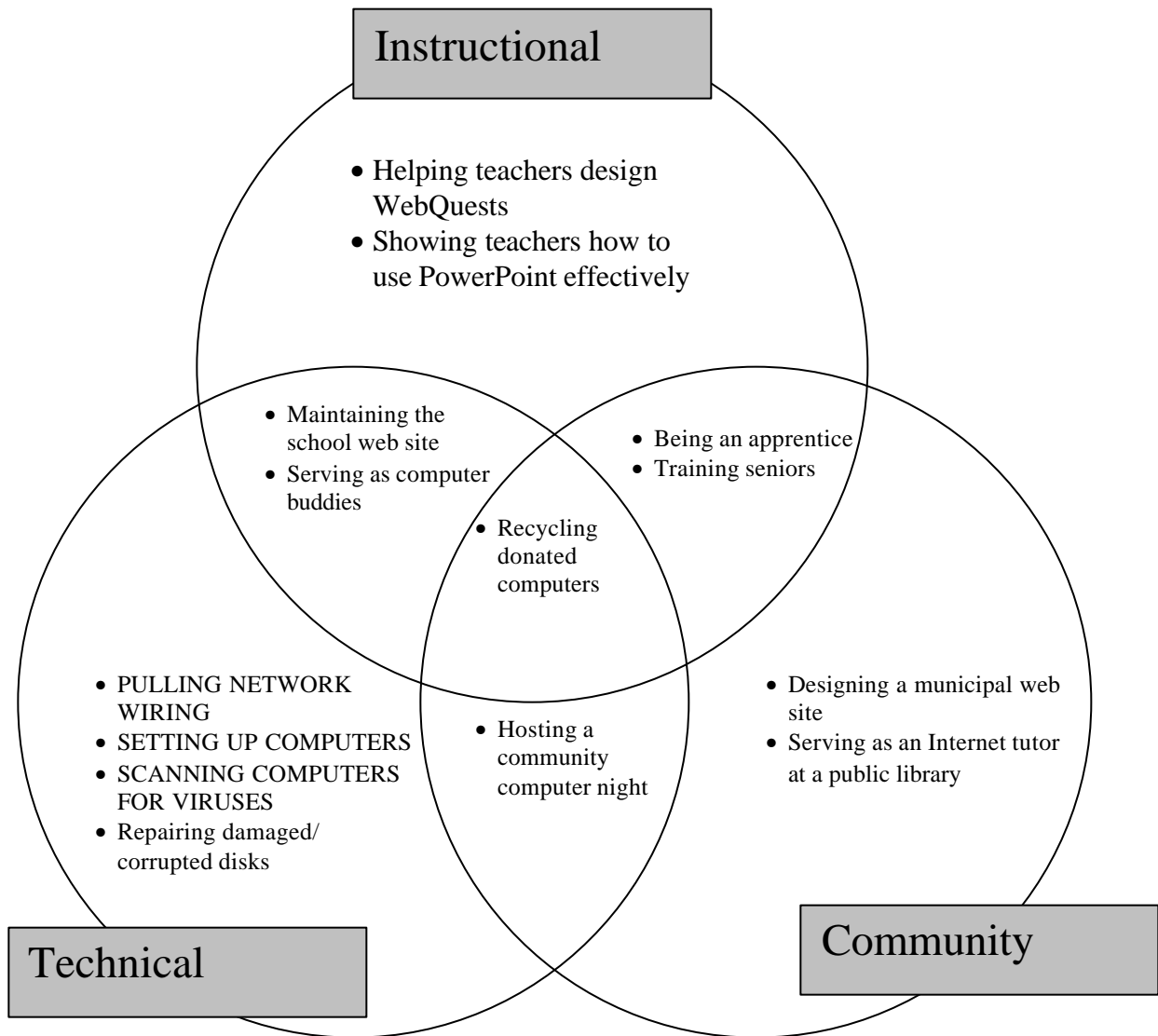


Figure 1. Three types of service provided by STAs.

### Analyzing Existing Resources

Once you have decided what kind of program you want to have, you need to examine what resources are currently available. You may want to gather some data through surveys and analysis of repair times and costs. However, it is important to remember that costs are not just measured in dollars; they are also measured in attitudes and use of technology, so include items about perceptions and use. Additional questions to answer about your school include:

1. Who provides technical support now?
2. Are the support goals being met?
3. What kinds of hardware and software do you have now?
4. What kinds of resources or programs are available at other schools in your area?
5. Are there ways to pool resources with other schools?

Talk to local businesses about your program; see if they may be willing to support it with initial donations of equipment, money, or staff. Are there employers in your area who have expressed an interest in helping prepare students for technology-related jobs? You may have to limit the program scope initially and focus on some high-

impact projects that will help sell the program to your teachers and to the community. In exchange, this may aid you in finding additional resources that you can then use to take on additional projects.

An STA program is not likely to be successful in the long run if its coordination is simply piled on someone who is already overworked. Whom will you get to coordinate the program? What will that person have to give up in order to do it? Who will pick up the slack? Are there parents or community members who can help? Perhaps in the initial year of the program, the school will need to provide a substitute teacher for one class to allow the coordinator to develop the program.

Make sure the people involved are dedicated to the idea of the program. Kentucky's statewide STA program, SLTP, emphasizes that coordinators must be prepared to serve as communicators, facilitators/mentors, and also managers. The state STLP web site (<http://www.kde.state.ky.us/oet/customer/stlp/coor.asp>) urges the selection of coordinators who possess the following characteristics:

- Knowledgeable and enthusiastic about technology
- Energetic in pursuing student participation
- Patient in pursuit of accomplishments
- Dedicated to the success for all students and the program
- A leader with excellent organizational skills
- Willing and able to solicit the support of administrators, peers, parents, students, professionals, and community organizations
- Adaptive, innovative, and reliable in fulfilling duties

### Initial Planning

There are other questions that merit early consideration. A partial list is offered by the Educators' Technology Center of Indiana:

- How will students be selected/recruited?
- What kinds of help will teachers/technicians be comfortable with?
- What age students will be involved?
- How will students be trained?
- What responsibilities will students have? Who will they report to?
- Will students be paid? Given credit? Otherwise recognized? (<http://etc.iupui.edu/pyop.html>)

Erica Peto, Esther Onishi, and Barbara Irish have published a handbook *Tech Team: Student Technology Assistants in the Elementary & Middle Schools* (1997), which is available from Amazon.com (<http://www.amazon.com>) and from the publisher's web site (<http://www.linworth.com>). The book, which is based on Peto's masters thesis describing the program in use at her Kent (Washington) elementary school, outlines how to publicize, organize, and manage an STA program. It provides lesson plans, sample forms, and strategies. On her school web site ([http://www.kent.wednet.edu/staff/epeto/tech\\_team/](http://www.kent.wednet.edu/staff/epeto/tech_team/)), Peto offers ClarisWorks versions of many of the forms in use at her school as well as early drafts of lesson plans and memos included in the book. Particularly useful are her suggestions regarding the selection process of student participants. She describes the many purposes of the interview and written application question:

- To determine the strengths of the student in the area of technology
- To determine the areas in which the student may need more instruction
- To determine the extent of experience the student has in technology
- To determine the ability the student has in working with adults and other students
- To determine the perception the student has as to what is expected of him/her as a Tech Team member
- To determine if the student has given some thought as to how this activity will fit into his/her overall schedule
- To determine the ability of the student to communicate orally and in writing
- To begin to build rapport with prospective Tech Team members

Similarly Lucy Miller, founder of the SWAT approach which is used heavily in North Carolina and elsewhere around the world, is preparing a manual and CD-ROM which will be available for purchase through the SWAT website (<http://www.swatweb.net/>). Miller encourages e-mail inquiries ([lmiller1@nc.rr.com](mailto:lmiller1@nc.rr.com)) regarding her fee schedule. Early versions of many of her forms were previously available on the SWAT website, including one form which contained a detailed and explicit parental approval section, "I understand that my child may leave their assigned classes for short periods of time, with teacher permission, to assist other teachers and students with

computer related activities. These activities align with the state and local student technology competencies. Membership on the SWAT Team is an enrichment activity and will be monitored by..." (<http://prometheus.educ.ncat.edu/users/swat/application.htm>). Miller stresses the importance of gaining parental approval in the first stages of the student's application process.

Another helpful checklist of initial considerations is offered by Kristin Kuntz on the Intel in Education web site ([http://www.intel.com/education/teachtech/classroom/tech\\_teams.htm](http://www.intel.com/education/teachtech/classroom/tech_teams.htm)).

## **Measuring Success**

Regardless of the type or scope of STA program you decide to implement, there are several factors that are considered key to success. This section outlines some of these factors in more detail.

## **Open Participation**

One of the false assumptions held about STA programs is that they require a highly skilled student base, and that they are, therefore, comprised of an elite corps of students. In actuality, STA programs are most successful when they are open to all students, even those with poorly developed technology skills. When students participate in an STA program, they are likely to learn from each other and from the training they receive as part of the STA program. There is often a snowball effect created once a majority of the students are sufficiently competent. Students who enter the program later are trained faster and often "invisibly" by their peers.

Successful STA programs set specific goals to include students who would not traditionally participate in such activities. Specifically, females, those without computers at home, and those who are academically less successful should be encouraged to participate. It is important to realize that girls tend to shy away from technology around the same time boys begin playing computer games. Too often these behaviors lead to a technology gap in high school that is never closed. Involvement in an STA program may address the long-term goal of promoting technology skills for girls. Similarly, students without computers at home often do not develop good technology skills. Including such students in an STA program can often help close the digital divide we read about every day. STA participants who are at-risk academically may develop more positive attitudes towards school and begin to view themselves as valuable members of the community.

## **Clearly Identified Mission, Goals, & Objectives**

When starting an STA program, you need to be very clear about the mission, goals, and objectives for your program. The mission and goals guide how you will develop your program. They help you communicate to the community and other potential sources of funding exactly how you have been successful and what you intend to do with any donated equipment, time, or funds. They also ensure that, when asked, individual members of the program give consistent and accurate descriptions of the program to those who may question what the value or purpose of the STA is for the participants.

## **External Motivation**

While the intrinsic motivation provided by STA programs can be high, some schools offer external motivation in the form of an hourly wage, typically in the range of \$5 or \$6 an hour. Another possibility is to offer scholarships or awards such as the two BellSouth STLP Scholarships given each year to seniors who have excelled in one of Kentucky's STLP programs (<http://162.114.158.30/scholar/new.htm>). The STLP annual conference for students provides students the opportunity to travel and to be recognized for their work. The STLP model also provides external motivation for schools and school districts in the form of Diamond, Gold, and Silver recognition. Recognition of community participants can also help boost community involvement.

## **Training & Support**

While some students and teachers who want to participate in your STA program may have skills, not all will. And someone who has technical know-how may not know how to apply those skills within the context of your STA program. Regular training for current and new STAs is required for the long-term success of a program. In addition, those who coordinate the program must get the support and time they need to manage the program effectively.

## **Organized and Effective Collaboration**

Your STA program needs to have a visible presence and contact person in the community. Interested individuals need to have easy access to program leaders in order to propose ideas or volunteer services. Students will grow through exposure to your community's multiple points of view and cultures. Again, this can't be done easily by a teacher or staff member who is coordinating the program in addition to other duties. It is probably best accomplished by the involvement of several community and business members who serve as leaders in the program.

## **Six Successful STA Programs**

Table 1 provides six examples of STA programs in place in K-12 schools today, along with a brief description of their areas of focus. This is followed by a more in-depth analysis of these programs and their components.

*Table 1 Profiles of Six Student Technology Assistant Programs*

Program	Type of program	What it does/more information
Issaquah School District Technology Information Project (TIP)	Primarily Technical	Probably the first formal STA program, TIP is offered as a middle school and high school course that includes work toward technical certification.  <a href="http://www.issaquah.wednet.edu/district/tip.htm">http://www.issaquah.wednet.edu/district/tip.htm</a>
Students Recycling Used Technology (StRUT)	Primarily Technical	Founded by Intel and the Northwest Regional Education Service District, StRUT became a statewide Oregon program in 1997-98. StRUT students evaluate, repair and refurbish donated computers and in turn donate those computers to local schools. The program has been replicated in other states.  <a href="http://www.strut.org">http://www.strut.org</a>
Generation Yes	Primarily Instructional	An outgrowth of Olympia (Washington) Network Navigators clubs, this program has received federal funding and recognition. Its curriculum teaches students the technology, presentation, and mentoring/teaching skills that they then use to help teachers integrate technology into their classrooms. It has recently expanded to include three additional curricula – one focused on community projects, one focused on network maintenance, and one addressing issues of students who “don’t like computers.”  <a href="http://www.genyes.org">http://www.genyes.org</a>
Kentucky Student Technology Leadership Program (STLP)	Technical, Instructional, and Community-Related	This well-organized program is administered on the state level and promoted in districts and schools across the state. Each year students participate in a statewide conference.  <a href="http://www.kde.state.ky.us/oet/customer/stlp">http://www.kde.state.ky.us/oet/customer/stlp</a>
Students Working to Advance Technology (SWAT)	Technical, Instructional, and Community-Related	SWAT is a network of schools that embrace the organization model developed by Lucy Miller in which students are assigned to task forces. Many SWAT schools are in North Carolina where students participate in a free statewide summer program.  <a href="http://www.swatweb.net">http://www.swatweb.net</a>
Tech Team	Technical, Instructional, and Community-Related	This program’s details have been well-documented by its founder Erica Peto and two classroom teachers who are active in the program. Documentation is geared toward elementary and middle schools.  <a href="http://www.kent.wednet.edu/staff/epeto/tech_team/">http://www.kent.wednet.edu/staff/epeto/tech_team/</a>



## Issaquah School District Technology Information Program (TIP)

The Technology Information Project (TIP) varies in its implementation from school to school within the Issaquah School District (<http://www.issaquah.wednet.edu/district/tip.htm>). However, in general all of the TIP programs follow an apprenticeship model of training. One former TIP coordinator, quoted in a Microsoft in Education case study ([http://www.microsoft.com/education/planning/implement/system\\_issaquah.asp](http://www.microsoft.com/education/planning/implement/system_issaquah.asp)), described his motto: "Every computer here is equipped with a teenager."

At the middle school level, all students are welcome regardless of their prior experience with technology. Students pledge to teach each other. At the high school level, students are expected to bring prior experience and skills. They are carefully screened during an application process that includes an ethics test and a teacher recommendation. Students accepted into the program receive course credit. In some cases, basic skills are taught not only through authentic learning assignments but also through a certification preparation program. In addition to these basic skills, TIP programs stress "an appetite for life-long learning and goal-setting" (<http://www.ims.issaquah.wednet.edu/isdtip.htm>).

Sample TIP projects include the following:

- Provide afternoon access to the school computer lab and library computer facilities
- Provide technical support for feeder schools and community centers
- Maintain the school's user network and mail accounts
- Help monitor security and space issues on the school's network
- Maintain and install all network wiring for the school
- Provide routine maintenance and technical support for the school
- Help train staff and students on the use of the school's computer workstations

The student-maintained TIP page for Liberty High School describes the philosophy of that school's program and its emphasis on public presentation of student work

(<http://www.liberty.issaquah.wednet.edu/TiPpage/philosophy.htm>): "Imagine how it feels for a sixteen year old to get up in front of a group of 'suits' some 300 strong and actually have them TAKING NOTES as you speak."

The following individual schools maintain TIP web sites:

- Issaquah Middle School
  - <http://www.ims.issaquah.wednet.edu/isdtip.htm>
- Issaquah High School
  - <http://www.ihs.issaquah.wednet.edu/ihtip/>
- Liberty High School
  - <http://www.liberty.issaquah.wednet.edu/TiPpage/>

## Students Recycling Used Technology (StRUT)

Another technology-focused STA program, StRUT, was co-founded by Intel and the Northwest Regional Education Service District in Oregon in 1995 (<http://www.strut.org>). The program was designed to refurbish and make use of donated computer equipment. Specifically, the goals of the program are as follows:

1. To develop programs where students gain valuable technical and business management skills by assembling, testing and loading software on donated computers.
2. To place these computers in schools throughout the area to supplement those purchased by the district.
3. To work with business partners to reduce the barriers preventing schools from accessing the Internet and other communication technologies.

StRUT has expanded to each of the 21 districts in Oregon. To date, more than 1,000 students have been involved in the StRUT program, and these students have refurbished over 15,000 computers and donated them to more than 70 schools. In 1999, StRUT received Oregon's SOLV Citizenship Award.

Most StRUT programs are run as after school clubs that emphasize field trips and rigorous participation in certification programs such as A+ and Cisco. Some StRUT programs have joined forces with Cisco Networking Academy to enhance this training. One such program is West Albany High School's Computer Networking Program. Its coordinator Dave Hudson is a 1999 recipient of the Oregon Innovators in Education Award. His report on the program is available online (<http://www.osba.org/salute/2000/sal0002.htm>).

The StRUT alliance, as an example of a technical STA program, has proven to be so successful that it has expanded beyond Oregon's boundaries. StRUT is being implemented in six other states -- Arizona

(<http://www.azstrut.org/>), California, Georgia (<http://www.sandersvilletech.org/gastrut/>), Massachusetts, New Mexico, and Texas (<http://www.txstrut.org/>).

The following individual Oregon schools are among those maintaining StRUT web sites:

- Sam Barlow High School
  - <http://www.gresham.k12.or.us/strut/default.html>
- Spray High School
  - <http://www.spray.k12.or.us/strut/strut.htm>
- Nestucca High School
  - <http://www.nestucca.k12.or.us/strut.htm>

## Generation YES

Generation YES (Youth and Educators Succeeding), a third STA program with roots in the Pacific Northwest, initially focused exclusively on instructional issues (<http://www.genyes.org>). Even now, the primary curriculum offered by Generation YES (variously called Gen YES, Gen Y, and Gen www.Y) is a training program that prepares students in grades 3 through 12 to serve as mentors to teachers who are integrating technology into their classroom teaching. Graduates of this semester-long program can now continue with the Gen DID curriculum (which focuses on a major community project). Students who demonstrate maturity and technical skills may enroll in the Generation SCI curriculum (Students Caring for Infrastructure, which focuses on computer network maintenance). A fourth curriculum, Gen GIT (Girls' Issues and Technology), is designed to meet the needs of girls who "don't like computers." The more than 500 schools in 41 states affiliated with Generation YES now constitute probably the most widespread STA network in the country.

An outgrowth of the Olympia School District's Network Navigator mentoring program, Generation YES received a federal Technology Innovation Challenge Grant in 1996. Dennis Harper, author of this initial grant, still serves as executive director for Gen Yes, which is now administered by the Office of Educational Research and Improvement (OERI). The Generation YES curriculum kits, which are aligned with the International Society for Technology in Education (ISTE) National Educational Technology Standards, are available for purchase through the ISTE bookstore (<http://www.iste.org/Bookstore/index.html>). The ISTE magazine *Learning and Leading with Technology* profiled Generation YES in October 1999 (<http://www.iste.org/L&L/archive/vol27/no2/features/harper/index.html>) and regularly features the writing of Gen YES students in its "Student Voices" column. In 2000, the U.S. Department of Education's Educational Technology Expert Panel recognized Gen YES as one of only two "Exemplary Programs" ([http://www.ed.gov/offices/OERI/ORAD/LTD/newtech\\_progs.html](http://www.ed.gov/offices/OERI/ORAD/LTD/newtech_progs.html)). Most recently, *USA Today* highlighted the program in an August 8, 2001, back-to-school article (<http://www.usatoday.com/life/cyber/tech/2001-08-06-students-tutor-teachers.htm>).

Students who participate in the basic program enroll in a semester-long (18-week) course to learn necessary technical skills and integration techniques to help their teachers with technology-related lesson planning. The program does not require students to have prerequisite technology skills, but the challenging nature of the curriculum does require significant student effort. Each student is paired with a teacher to assist with a lesson or project's technology integration.

In one such project for a social studies class, an STA helped a teacher develop a unit on Graham County history that made use of a scanner, digital video camera, Avid Cinema editing software, and Photo Deluxe image editing software. The teacher and the STA filmed different historical sites around the county using a digital video camera. Students in the teacher's class meanwhile collected pictures of Graham County that were then scanned in and combined with the video, which was edited to include music. The video was then shown to the class as part of the unit on the history of Graham County, and students were tested on the content.

Another project developed for a science class took a chapter from the class textbook and created storyboards for the chapter. These storyboards called for pictures and images for illustration, which were gathered from the Internet, the textbook, and other print resources. Images were scanned as necessary and, combined with the storyboards, were then used to create PowerPoint slides. The teacher presented the unit to the class.

In a third project, for an English/Language Arts class, an STA worked with the teacher to teach students how to use a digital camera to take pictures and how to edit those pictures in an image editing program. As a practice assessment, the teacher and students went on a scavenger hunt, taking pictures of specific objects and then editing them. The teacher and the STA developed "story starters" which the students then elaborated, continuing the stories and illustrating them with digital photos. More projects and information can be found at <http://www.genyes.org/genwwwy/>.

Below are just some of the web sites of participating Gen Yes schools:

- Argyle Central School (Argyle, New York)
  - <http://www.nheep.org/SchoolWebs/argyleweb/Programs/GenY.htm>
- Birmingham High School (Los Angeles, California)
  - [http://www.lausd.k12.ca.us/Birmingham\\_Magnet\\_HS/GENYWEB/](http://www.lausd.k12.ca.us/Birmingham_Magnet_HS/GENYWEB/)
- Thurgood Marshall Middle School (Olympia, Washington)
  - <http://kids.osd.wednet.edu/Marshall/homepage/thurgoodmarshall.html>

### **Kentucky Student Technology Leadership Program (STLP)**

Kentucky's Student Technology Leadership Program (STLP) exemplifies a state-organized STA program (<http://www.kde.state.ky.us/oet/customer/stlp>). According to its web site, 828 Kentucky schools in 165 Kentucky school districts currently participate. Although at first glance its vastness and organizational complexity may seem intimidating, many of STLP's features are noteworthy even for rural schools who are considering implementing a small-scale STA program. Specifically, Kentucky's program involves students in technical, instructional, and community-related projects, making its usefulness broader than one specific area. Additionally, the program provides local districts with state-level guidance, a feature that helps insure that proper instructional objectives and standards are being met. The state-organized nature of the program allows for more uniform development and collaboration across the state. State-run competitions and student conferences assure that students work hard to maintain a high quality of work.

Kentucky's STAs have performed a number of technical-related tasks. Specifically, they have created and maintained web pages, wired classrooms and laboratories, produced videos, and assisted faculty members with technology-related problems. These projects are varied and numerous and go beyond simple technical troubleshooting.

The instructional projects of Kentucky's program are also broad and diverse. Students have developed brochures, mentored younger students, developed electronic portfolios, evaluated software, and provided technical instruction. One STA school developed a PowerPoint presentation on the state of Kentucky using graphics and sounds of the state bird and the state song. Another STA school implemented electronic portfolios of HyperStudio work, studied and reported on technology related issues such as Y2K, developed web-based curriculum, illustrated poems with digital pictures, built WebQuests for several topics, created audio/video broadcast coverage for campaigns and a shuttle launch, and generated a variety of print-based materials such as news letters and newspapers. In another school, students reviewed software programs and then held a showcase to introduce the software to teachers. Another project enlisted STAs in helping parents learn how to use the Internet during weekly "Internet night" workshops. STAs in yet another program developed a program called "Technology Opportunities in the Library." Teachers attending this program learned how to use a digital camera, a scanner, HyperStudio, and a Laserdisc player. Ideas for integrating these technologies into classroom curriculum were also presented. There are also scores of instances where STAs have helped teachers and community members learn to use programs like Excel, Powerpoint, and Hyperstudio; to troubleshoot and maintain classroom computers; and to use a variety of hardware.

STLP has generated hundreds of community projects. Students in this program have helped maintain city web sites and build and maintain web sites for community organizations and schools. They have converted networking systems and installed computers for neighboring schools, conducted research and web page maintenance for local companies, and taught community education classes in PowerPoint and other software applications. They have made holiday cards and large-print phonebooks. They have held workshops for senior citizens in assisted-living facilities, managed and supported a lending library for software and hardware open to the community, and created business cards and pamphlets for local organizations.

Providing technical, instructional, and community-related assistance to others follows the mission of Kentucky's Student Technology Leadership Program. The STLP mission aims to advance the individual capabilities of all students, to motivate all students, and to create leadership opportunities through the use of technology. The specific goals of this mission are as follows:

- The STLP will develop activities that enhance the academic, social and emotional growth of the student.
- The STLP will provide leadership opportunities for all students.
- The STLP will experience multi-age collaboration by forming innovative learning partnerships.
- The STLP will form learning partnerships between students with different technology skills.

- The STLP will develop activities that benefit communities.
- The STLP will develop instructional activities which integrates technology and benefits the school and support KETS (Kentucky Education Technology System)

From its inception, these six goals have guided STLP. In her 1999 *Learning and Leading with Technology* article, Elaine Harrison describes the advisory council that formulated these goals and structured the program in its early days. She notes, “The Kentucky Department of Education gave grants (\$1,000 per year) to the initial STLP schools for the 1994–95 and 1995–96 school years.” Online manual materials describe the program’s structure – an adult STLP coordinator for the school and student cluster coordinators for individual projects – and the process followed to create a unified action plan that meets the program’s six goals.

One notable aspect of Kentucky’s program is its inclusiveness. The program strives to include a population fully representing the school’s diversity. This means that the program aims to draw females, minorities, and special education students. Activities are scheduled with a flexibility that assures that no student is excluded on the basis of schedule. As a means of assuring inclusiveness, the STLP program stresses four important roles for students involved in the program – starter, liaison, trainer, and provider.

Below is a sampling of individual STLP web sites:

- Charles Russell Elementary School
  - <http://crussell.ashland.k12.ky.us/stlp/stlp.htm>
- Paul Lawrence Dunbar High School
  - <http://www.pldhs.com/stlp.html>
- Region 6
  - <http://www.k12.ky.us/oapd/rsc6/stlp.asp>

### **SWAT – Students Working to Advance Technology**

Another nationally recognized STA program, SWAT, focuses its efforts on student leadership training, technology integration, and community outreach. Although the program has been implemented across the nation, individual programs are expected to each have their own personality. SWAT teams, as many implemented programs have been called, are supported by guidelines (<http://www.fetc.org/fetcon/1199/swat.html>), yet each of the programs are expected to assess the technological needs of their local school and community.

Students who are interested in participating in a SWAT program are usually required to complete a job application and complete an interview. In this way, teachers can more appropriately evaluate the types of programs to embrace, and perhaps more importantly, to effectively match students with technology tasks.

After assessing the technology needs of the local school and community, those who are implementing the SWAT program are encouraged to do the following:

- Communicate concerns with administrators, teachers, and the community
- Develop a program mission, with goals, priorities, a plan of action, and a method of evaluation
- Announce the plan to the students
- Distribute applications and obtain parental permission
- Conduct interview to build SWAT teams
- Assess the technology needs of the local school and community
- Train the students
- Monitor and evaluate the program

Task Force Teams, the organizational name given to a job that a student is assigned to complete, can include any number of responsibilities. Examples of these teams include the following: TV/Weather Internet Crew, Internet Researcher, Web Master, and Computer Buddy. Of course, the possibilities are limitless for teams and responsibilities. But again, local needs should drive the development of teams.

During summer 2001, the second annual SWAT Camp was offered to North Carolina’s SWAT students at seven CyberCampuses <[http://www.dlt.ncssm.edu/swat/swat\\_camp.cfm](http://www.dlt.ncssm.edu/swat/swat_camp.cfm)>. The program, which is free to students, is funded through a Technology Innovation Challenge Grant.

One web site hosted by the North Carolina School of Science and Mathematics serves as a resource for ten high school SWAT programs in North Carolina <<http://www.dlt.ncssm.edu/SWAT/index.cfm>>. This consortium of SWAT programs is currently planning a portfolio process by which students can become “SWAT Team certified” in web page design: “Certification implies that the student is capable of designing pages for school community members and organizations.”

Below are a sampling of other school web sites affiliated with SWAT:

- Narragansett Elementary School (Narragansett, Rhode Island)
  - <http://www.ri.net/schools/Narragansett/NES/SWAT/swat.html>
- Eastview Elementary School (Connersville, Indiana)
  - <http://fayette.k12.in.us/eastview/computerclub.html>

## Tech Teams

Erica Peto's model for TechTeams has been cited as an influence for a variety of programs, including the Ballard Tech Team, which is a featured School Web Clubs web site <<http://supportnet.merit.edu/webclubs/featured1.html>>. In a June 2000 *Education World* article, Ballard teacher Marcia Cousins explains, "As the tech people in our building, we were becoming more and more overtaxed and overwhelmed with trying to teach and also be the 'techies'... As we added more and more computers, the task increased. Hence, the idea for a tech team evolved. We had the opportunity to see a presentation on tech teams and had the resource of a book -- *Teams, Student Technology Assistants in the Elementary and Middle School*, published by Linworth Publishing [ISBN 0-938865-60-9]. This book is geared just towards a tech team and not a Web club. Ours has developed into both" <[http://www.educationworld.com/a\\_tech/tech035.shtml](http://www.educationworld.com/a_tech/tech035.shtml)>.

Similarly, Mississippi's new CREATE (Challenging Regional Educators to Advance Technology in Education, <http://www.create4ms.org>) program draws from Peto's model in designing student Techno Teams who provide support for the program's technology carts. Schools within the CREATE program are encouraged to gain ideas and inspirations from Peto's workbook but to create tech teams suited for their own schools.

Peto's model, as described on the web site <[http://www.kent.wednet.edu/staff/epeto/tech\\_team](http://www.kent.wednet.edu/staff/epeto/tech_team)>, is designed to meet the needs of her own school, Daniel Elementary, as well as other schools in the Kent School District. As she explains, "The main function of the Tech Team is to assist during media block (a combination of library and computer classes). Tech Team members also help during preschool and Head Start preschool computer center time."

Tech Team members at Daniel are fourth, fifth and sixth grade students who volunteer to miss approximately one hour of class time per week and make up that work on their own: "During this time, they assist students who are learning to use technology and working on technology-related projects. In addition, Tech Team students agree to attend a training session once per week. Last year this training time was held after school but this year it is held during lunch recess."

The school's web site <[http://www.kent.wednet.edu/KSD/DE/st\\_proj/st\\_proj.html](http://www.kent.wednet.edu/KSD/DE/st_proj/st_proj.html)> offers a glimpse of a variety of impressive student projects supported by Daniel's Tech Team members.

## Conclusion

As these models demonstrate, STA programs can be an excellent way for schools to promote technology integration, for teachers and students to gain technology skills, for students to become more involved and committed to their communities, and for communities to gain services they could not otherwise get and a more educated workforce. In most cases, the start-up costs are small.

Before embracing one of these models or creating your own, you should first explore what is being done in other schools in your state. Have several schools within your state adopted the Gen Yes curriculum? Does StRUT operate in your state? Is there a large employer in your state interested in helping coordinate a StRUT-like program? Is your State Department of Education considering a statewide initiative such as Kentucky's? Perhaps your state can achieve the synergy Mississippi schools achieved when they applied for and acquired federal funding for the CREATE project.

The key to any successful program must be that it meets the needs of your school and your students. And though STA programs have proven helpful in addressing schools' budgetary crises, no STA program should be viewed as a permanent replacement for budgeted technical support dollars. For the full potential of STA programs to be achieved – technical, instructional, and community – the focus must firmly centered on students' academic needs.

## References

Bafile, C. (2000). Establish a computer club: Big benefits for students and staff. *Education World*. Retrieved June 22, 2001, from the World Wide Web: [http://www.educationworld.com/a\\_tech/tech035.shtml](http://www.educationworld.com/a_tech/tech035.shtml)

Brown, M.B. (2000, November). Tech apprentices: Kidspeak interviews five teens who serve as the technical support staff for their school district. Kidspeak. Retrieved June 22, 2001, from the World Wide Web: <http://www.4teachers.org/kidspeak/nils/index.shtml>

Bushweller, K. (2001, January). The new networkers: The path to hot IT jobs begins in high school. Electronic School. Retrieved June 14, 2001, from the World Wide Web: <http://www.electronic-school.com/2001/01/0101f1.html>

Cattagni, A., & Farris E. (May, 2001). Internet access in U.S. public schools and classrooms: 1994-2000 (NCES 2001-071). Washington, DC: National Center for Educational Statistics. Retrieved June 22, 2001, from the World Wide Web: <http://nces.ed.gov/pubs2001/2001071.pdf>

Challenging Regional Educators to Advance Technology in Education (CREATE) for Mississippi web site. Retrieved June 22, 2001, from the World Wide Web: <http://www.create4ms.org>

Consortium for School Networking (June, 1999). Taking TCO to the classroom: A school administrator's guide to planning for the total cost of new technology. Retrieved April 5, 2001, from the World Wide Web on April 5, 2001: <http://www.cosn.org/tco/tco2class.pdf>

Educators' Technology Center of Indiana. Plan your own program. Retrieved June 14, 2001, from the World Wide Web: <http://etc.iupui.edu/pyop.html>

Expert Panel on Educational Technology. Exemplary and promising educational technology programs: 2000. Retrieved June 22, 2001, from the World Wide Web: [http://www.ed.gov/offices/OERI/ORAD/LTD/newtech\\_progs.html](http://www.ed.gov/offices/OERI/ORAD/LTD/newtech_progs.html)

Harrison, E. (October, 1999). Student Technology Leadership Program. Learning and Leading with Technology. Retrieved June 22, 2001, from the World Wide Web: <http://www.iste.org/L&L/archive/vol27/no2/features/harrison/index.html>

Harper, D. (October, 1999). Why Gen www.Y? Learning and Leading with Technology. Retrieved June 22, 2001, from the World Wide Web: <http://www.iste.org/L&L/archive/vol27/no2/features/harper/index.html>

Huffstutter, P. J. (August 31, 1998). The cutting edge; learning or labor? Some crash-strapped schools use students as tech support; critics say that's exploration. Los Angeles Times, D(1).

Issaquah School District TIP web site. Retrieved June 22, 2001, from the World Wide Web: <http://www.Issaquah.wednet.edu/district/tip.htm>

Kentucky Student Technology Leadership Program web site. Retrieved June 22, 2001, from the World Wide Web: <http://www.kde.state.ky.us/oet/customer/stlp/>

Kongshem, L. (2001). School district technology managers learn to do more with less. Electronic School. Retrieved June 4, 2001, from the World Wide Web: <http://www.electronic-school.com/2001/06/0601helpdesk.html>

Kuntz, K. Technology in the classroom: Tech teams. Retrieved June 22, 2001, from the World Wide Web: [http://www.intel.com/education/teachtech/classroom/tech\\_teams.htm](http://www.intel.com/education/teachtech/classroom/tech_teams.htm)

Microsoft in Education. Issaquah School District. Retrieved June 22, 2001, from the World Wide Web: [http://www.microsoft.com/education/planning/implement/system\\_issaquah.asp](http://www.microsoft.com/education/planning/implement/system_issaquah.asp)

Miller, L., & Cobitz, C. (1999). Students working to advance technology: The SWAT team. FETConnections. Retrieved May 29, 2001, from the World Wide Web: <http://www.fetc.org/fetcon/1199/swat.html>

National Telecommunications and Information Administration. (2000). Falling through the net: Toward digital inclusion. Washington, D.C: NTIA. Retrieved June 22, 2001, from the World Wide Web: <http://www.ntia.doc.gov/ntiahome/digitaldivide/>

Oregon School Boards Association. (2000). West Albany High School: Computer network program. Retrieved June 22, 2001, from the World Wide Web: <http://www.osba.org/salute/2000/sal0002.htm>

Peele, E. (April, 2001). Call in the SWAT team. Learning and Leading with Technology, 28(7), p. 40. Retrieved June 22, 2001, from the World Wide Web: <http://www.iste.org/L&L/archive/vol28/no7/index.html>

Peto, E. L., Otumaru, E., & Irish, B. K. (1998). Tech Team: Student technology assistants in the elementary and middle school. Worthington, Ohio: Linworth Publishing.

Students Recycling Used Technology web site. Retrieved June 22, 2001, from the World Wide Web: <http://www.strut.org>

Students Working to Advance Technology web site. Retrieved June 19, 2001, from the World Wide Web: <http://www.swatweb.net/>

Tech Team web site. Retrieved June 22, 2001, from the World Wide Web: [http://www.kent.wednet.edu/staff/epeto/tech\\_team/](http://www.kent.wednet.edu/staff/epeto/tech_team/)

Thomas, K. (August 6, 2001). Students tutor teachers in tech. USA Today. Retrieved August 22, 2001, from the World Wide Web: <http://www.usatoday.com/life/cyber/tech/2001-08-06-students-tutor-teachers.htm>

Vail, K. (June, 1999). Kids at work: The pros and cons of using students as technology workers. Electronic School. Retrieved June 4, 2001, from the World Wide Web at <http://www.electronic-school.com/199906/0699sbot.html>

# S.O.S. For Information Literacy: A Tool for Improving Research and Information Skills Instruction

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## ABSTRACT

*At no time in history has the ability to locate, organize, evaluate, manage and use information, skills collectively referred to as information literacy, been more important to today's learners. Classroom and technology teachers and library media specialists are challenged to find effective, innovative techniques for teaching research and information skills, especially to young children. This paper summarizes the research conducted for a U.S. Department of Education Phase I SBIR award. The project utilized digital video, database, and information technologies, to design a proof-of-concept prototype for a comprehensive Web-based tool, **S.O.S.**, for improving instruction in this critical area. Educators identify relevant situation-specific variables (**S.**) and desired instructional otcomes (**O.**). Suggested instructional strategies (**S.**) are subsequently generated. These strategies are linked to a database of real-world video and multimedia examples. **S.O.S.** will be responsive to advancing technology and include system feedback mechanisms as well as direct user input for continuous formative evaluation and improvement. By integrating sound pedagogical principles with real-world practice presented in video and multimedia demonstrations, the project will make a valuable contribution to the quality of information literacy skills instruction.*

## Introduction

This paper highlights the main activities and results of an SBIR Phase I project to research and design a proof-of-concept prototype for improving instruction in information literacy. It utilized digital video, database, and information technologies in a comprehensive tool, **S.O.S. for Information Literacy**, for improving instruction in this critical area. Educators identify relevant situation-specific variables (**S.**) and desired instructional otcomes (**O.**). Suggested instructional strategies (**S.**) are subsequently generated. These strategies are linked to a database of real-world video demonstrations.

A high degree of success was achieved for all Phase I objectives. Top level objectives included 1) performing a front-end analysis to determine how best to design a Web-based information system that meets the needs of its target audience (elementary library media specialists and teachers) 2) designing the Phase I specifications (e.g., scope/organization of content, project curriculum, and design specifications for the proof-of-concept prototype, 3) producing the Phase I prototype including data structure, sample videos, and user feedback mechanisms, and 4) evaluating the proof-of-concept prototype across a number of variables including ease of use, technical reliability, quality of content, interface design and general appeal. Major accomplishments included:

- The development of an online Research Management Site provided an excellent environment within which the Phase I research activities occurred and will prove useful as the project continues into its development phase.
- A survey of 192 practitioners supplied critical information on the target audience's needs and preferences as well as clarification of a number of content issues.
- A questionnaire to faculty and leaders (n = 8) illuminated the need to add several subskills to the search parameters in Phase II, and provided useful information for dissemination of S.O.S. project information.
- Input evaluation resulted in guidelines for software development and video production.
- Production, post production, and compression of 18 sample videos demonstrated that quality video could be delivered via the web at high compression schemes.
- Sophisticated data structure and query systems were the outcomes of software development over two iterations of the proof-of-concept prototype.



- A Focus Group (n = 11) of potential users helped to elucidate the results of the earlier practitioners' survey and to beta test the first iteration of the prototype.
- Evaluation of 2<sup>nd</sup> iteration prototype by a Progressive Feedback Panel (n = 11) yielded valuable information for Phase II development relating to functionality, technical quality, and interface and design issues.

The remainder of this paper will briefly discuss each of the above accomplishments, and conclude with information on current development efforts.

### **Development of Research Management Site**

The Research Management Site (RMS) was a controlled online environment within which the Focus Group and Progressive Feedback Panel activities took place. The Focus Group (which will be described later) tested the first iteration prototype while the Progressive Feedback Panel tested a later version. The RMS was first developed in HTML and then brought into the WebCT Courseware so that threaded discussions could take place. Additionally, it served as a jumping off spot to link to the S.O.S. beta test site and as a return point to continue in the Focus Group or Progressive Feedback Panel mode. The success of conducting research within the RMS environment in Phase I has set the stage for successful research efforts in Phase II.

### **Results of Online Practitioners' Survey**

A 40-item survey was designed to gather feedback on potential curriculum content, perceived usefulness of the product, and plans for current and future technology implementation in respondents' schools and homes. The survey was designed as a comprehensive set of items including multiple choice, short answer, and open-ended questions. The first draft of the survey was piloted with 32 graduate students enrolled in a class called "Instructional Strategies and Techniques for Information Professionals" at Syracuse University, School of Information Studies. The pilot test served three purposes: 1) test the appropriateness of the survey's dissemination medium, 2) test the robustness of the dissemination medium, and 3) garner item feedback. After some modifications the survey was announced on several listservs (e.g. LM\_NET, ED-TECH) and 192 library media specialists, teachers, and technology coordinators responded.

Ninety-four percent (94%) of respondents indicated that the S.O.S. system as described would be either "useful" or "very useful" to library media specialists and 85% felt it would be "useful" or "very useful" to classroom teachers. Participants were given a number of potential uses for S.O.S. and, while the majority indicated the importance of all the options, using S.O.S. to help with lesson planning (85%; 163) was the highest rated response. Stimulating ideas (80%; 152), providing background information (67%; 127), and allowing practitioners to compare strategies provided with current practice (65%; 124) were also highly rated uses. Fifteen (8%) indicated "other" (e.g. professional development, use in education courses). Information was also gathered on information skills and subskills to include in the system. Respondents overwhelmingly agreed that the inclusion of lesson plans would be a highly motivating component of S.O.S. and that standards tie-ins would also be important.

### **Questionnaire to Selected College Educators and Leaders in the Field**

The purpose of the questionnaire was to gather consensus on the appropriate scope of content to include in the S.O.S. tool and to gather feedback on the proposed features of the tool. A group of 11 individuals was initially targeted for participation. Eight of 11 responses were received. The results of this survey were clarifications of several skills and the addition of several subskills to search options for the tool in Phase II. This group provided useful suggestions for publicizing and motivating educators to use S.O.S. Respondents also provided a number of suggestions for S.O.S. features which included:

- A listserv to allow people to trade comments and make suggestions as well as contribute lessons
- A way to add comments/reflections to the site which would then be available to others to peruse
- Printable lesson plans
- Links to content standards
- Lessons that reflect collaboration with classroom teachers in specific subject areas
- Printed transcripts of video/audio clips

## Input Evaluation

Early on, an input evaluation was conducted in-house and extended to several outside consultations with technology persons who frequently work with Creative Media Solutions. Technical specifications for software development were considered and a preliminary web-based data entry structure was planned using an SQL client/server environment. Many video issues were also considered such as what features were accessible by the majority of educators that would be testing our product and what long-range features could be anticipated for the ultimate release of the product. Decisions about frame size, delivery format, and compression algorithms were made after testing factors such as download time of various options with typical users' computer systems. These decisions are discussed further in the sections below.

## Video Production and Acquisition

Only original materials produced by Creative Media Solutions were planned for the prototype. Eighteen videos were included in the prototype ranging in length from approximately :25 to 4:30 minutes. Teachers and librarians from 4 Northeast states participated: New York, Pennsylvania, Massachusetts, and New Hampshire. In addition to videos produced entirely by the company, two videos were compiled from still photos sent in by a school in a Boston, Massachusetts suburb. Photos covering a six-week unit by a teacher in New Hampshire were also compiled into a multimedia PowerPoint presentation.

The style of production is similar to ENG production (electronic news gathering) in that the production team consists of the producer and videographer and sometimes an assistant. This is necessary because what happens in the course of a teaching episode is not entirely predictable; sometimes the camera is on the tripod and other times it is simply handheld. The production team attempts to be as non-intrusive as possible during the videotaping. There is generally little discussion ahead of time as to where in the library media center the librarian or students will be at any one time. The videographer simply documents the events.

With several exceptions, the production team was not allowed to videotape children's faces. This posed a challenge but did not compromise the quality of production.

The library media specialist was generally interviewed *after* the teaching episode. By conducting the on-camera interview afterwards, the producer/interviewer could frame her questions in the context of the actual lesson and the reactions from children she observed.

Each raw videotape (unedited field tape) was reviewed and shots or soundbites (also referred to as "clips") logged using timecode that would help to demonstrate a particular strategy. Scripts were written to guide the editing process providing detail on all shots selected including their sequence and sometimes duration. Interview soundbites were included and narration was written where needed. Any transitions (e.g., dissolves, wipes, etc.), music/effects, and text were also noted in the script. Voiceovers were recorded when appropriate.

The selected clips and voiceovers were then captured into the computer using Firewire and digital capturing software made by Pinnacle. Next, the captured clips were brought into editing software such as Media 100 or Adobe Premiere (for this example, Adobe Premiere) and laid out on a timeline. Titles and identifying text were created including a summary of the strategy used. Voiceovers were added when indicated. Transitions were created.

The timelines with all their elements were rendered as complete movies in AVI uncompressed format at 360 X 240 pixels down from their original size of 720 X 480 pixels. As planned, the finished AVI movies were taken into another industry standard program called Media Cleaner Pro for compression and . reduced to a 240 X 180 pixel frame size and rendered with Sorenson compression at 15 frames per second with audio at 22 kh.

The final step was adding the video to the video demonstration database to be linked to strategies and lesson plans.

Two professional looking albeit simple (in terms of video production techniques) videos that the Progressive Feedback Panel felt represented an acceptable alternative to only motion videos in the database were created from still photos sent in by a teacher in Massachusetts, proving to be a viable and cost-effective alternative to only motion videos.

A number of implications for future acquisitions of video content were determined. They include but are not limited to loaning library media specialist/teacher teams digital video or digital still cameras for 2 - 3 months at a time to capture teaching *in action* clips. The equipment would be bicycled to different areas to expand geographic coverage. The alternative production method, mentioned earlier, of using still photos to create a video would also open up participation to many individuals. All footage and stills would be sent to Creative Media Solutions for post-production including adding voiceovers, titles, etc., helping to maintain a consistent look. Online training resources

to be developed in Phase II could help prepare teams for acquiring video and preparing their work for submission to the S.O.S. project.

### **Development of Data Structure and Query System for Initial Prototype**

Phase I technical development goal was to collect information from a variety of sources, provide a mechanism to enter or query data, and deliver a wide variety of media as efficiently as possible to a diverse market. This solution was then integrated into a comprehensive Web site.

Data Structure. A relational database was custom developed to insure all facets of the project goals could be realized. A number of changes and additions were added to the database over the development cycle. Bringing the vision of the academic information literacy professional and translating into technical development introduced a series of challenges that were overcome. The solution consists of over thirty data tables, hundreds of data relationships and a client server interface as well as a Web interface. The final product has almost no artificial limits to data entry. Strategies can be related to lesson plans, lesson plans can be related to strategies and an unlimited number of resources can be attached to either. Supported resources include but not necessarily limited to; QuickTime video, Power point, text, QuickTime audio, pictures, and Web links. Special care was taken to allow content to be cross-referenced.

Another important aspect to consider was data entry. The user interface was designed to allow professional staff to quickly learn the necessary skills and offer automated entry functions when possible. Feedback on navigation, view, data required on screen and the complexities of identifying all the associated links were all considered. This is an evolving process, but the current solution has met the data entry requirements to this point.

Query. Query screens fall into two categories. Within the client server environment, queries have relatively unlimited options and occur very quickly. The query is an integrated function of the development software. As the complex data relationships that empower the information are ported to the web, significant slowdowns occurred. This was an anticipated result and a number of solutions are possible. The initial investment was made in understanding the data flow and allowing for the data to be entered correctly. As indicated above, this led to a number of adjustments. Optimization of code occurs in logical sequence, and every adjustment has a potential ripple effect throughout the code that is not always possible to predict. The next phase of development will focus on additional data indexing; relationship based queries, and a continued focus on utilizing the best technology tools available at the time of product delivery. During Phase I, the focus was on utilizing Active Server Pages with SQL queries embedded into the HTML page and CHTML tags with proprietary software. We feel that all issues of query speed from a Web centric view will be resolved transparent to the user. It is also anticipated that more features will be added to the data structure that will impact the solution as development continues.

Data delivery. Data delivery from the Web site introduced a number of variables inherent in the diverse world of Internet users. The expectation was data would be accessed by a current Web browser, would require Flash and Quicktime plug-ins, and the user would have dedicated Internet access. This expectation was not what occurred. This solution requires the ability to develop and distribute complex pieces of information. Multiple versions of multiple browsers demand constant day to day troubleshooting. From our research, we can see just how problematic this can be. For example, Netscape, particularly in earlier versions, did not fare as well as Internet Explorer with our prototype. There is a wide array of variables unique to each browser and specific version. The problem then becomes “which version do we adjust code to support”? As mentioned previously the effect of software adjustments at one level can and will affect results in other levels. Some panel members using both old browsers and old “systems” required technical support from our staff in order to complete the research. The compatibility problem is further complicated by the fact that competition has the various browsers introducing newer, better, faster features but that the different browsers (while trying to maintain competitiveness) still do so at different paces.

A decision that faces every developer is whether to adjust code to the lowest common denominator approach or choose a solution somewhere between the lowest and the highest common denominator. This project demands fairly complex searches on multiple variables. It includes videos, some of which can be up to four or five minutes in length. What our research is indicating, from a technical perspective, is that the lowest common denominator approach will not be the best one for this project. While some web databases do just fine with this

approach, they do not have the many additional variables to deal with as one such as the S.O.S. project with its multimedia content.

Judging from the results provided by users, the complexity of supporting multiple browsers limits delivery options to an unacceptable level. Internet Explorer version 5 or greater has proven to be the most reliable with this project. Current versions of Internet Explorer and Netscape will likely be recommended as viewing engines. Perhaps, by the time this resource is available, the browsers will have achieved an overall consistency that eliminates this issue. For now, the delivery goal will dictate browser selection and support. Browsers are typically free, are upgraded regularly, and have many settings and options to enhance web experiences.

Will our decision eliminate many potential users? The question is not whether the site can be viewed, but more precisely can the site be experienced to the full potential. It is not unusual today to see messages such as “best viewed by...” While we may lose some users, we will try to minimize that loss by making the necessary software or upgrades easily available to the user. Furthermore, most current computer operating systems include versions of both Netscape and Internet Explorer. Navigating the site in the preferred browser should be less of a problem. Information reduces anxiety. Providing information to the user about technical needs for an optimum experience will also reduce possible frustration when problems are encountered but users don’t know why.

### **Results of Focus Group**

The Focus Group consisted of 11 pre-service and in-service educators (potential future users of S.O.S.) most of whom were library media specialists. They were from New York State, North Carolina, and Virginia. Because of the distributed geographic location of focus group participants, all focus group sessions were conducted online using the Research Management Site and WebCT’s asynchronous discussion feature rather than the traditional face-to-face method. The Focus Group provided valuable feedback on important issues that related to the scope of content, inclusion of standards, value of lesson plans, variety of videos, amount of information presented in videos, links, and a number of other issues. At this point in the research, only content and curriculum related issues were explored. Interface and design issues were not addressed in the Focus Group. They reviewed content issues in the context of a very plain and simple interface on a beige background. This group also provided input that resulted in the adoption of the national information literacy standards put forth in *Information Power: Building Partnerships for Learning* published by the American Association of School Librarians (AASL) and the Association of Educational Communications and Technology (AECT) in 1998, as the basis of the standards search. Quality control of content was also considered an important attribute of the future tool. The Focus Group provided a number of possible ways to insure quality control of content including a quality assurance committee, expansion of the online feedback mechanism, and the development of an evaluation tool. The consensus seemed to be that anything uploaded to the S.O.S. site should be considered a quality product.

### **Evaluation with Progressive Feedback Panel**

Based on feedback and recommendations from the Focus Group, the development team made modifications and additions to the initial prototype for testing with another group of educators described below. In this iteration, videos were linked to the strategy or lesson plan generator in which search variables included specific situation (grade and context) and outcome (information skills and subskills) variables. The results of such a search are strategies or lesson plans which have links to a video/multimedia database. We also added a video “**quick search**” where a user can search on a video topic using only a topic keyword.

A comprehensive questionnaire was developed by the principal investigator and senior project consultant that would elicit feedback in two main areas 1) Searching functionality across strategies and videos, lesson plans, topics, and standards, and 2) Interface and design. This site was then presented to the Progressive Feedback Panel who helped us evaluate the 2<sup>nd</sup> iteration of the proof-of-concept prototype in the above areas and on specific issues that included: ease of use, features that might attract educators, quality of content, technical quality, menu buttons, color appeal, etc.

(Whereas the Focus Group was concerned with content issues and functionality, this group was also concerned with interface issues.)

The Panel consisted of several members from the original Focus Group plus new members. This configuration was chosen to provide a balance between continuity of feedback and fresh input from persons not previously connected with the project. Eight library media specialists, 2 classroom teachers, and 1 district-wide technology coordinator comprised the group. They were given instructions for reviewing the site individually, and subsequently filled out a comprehensive questionnaire.

In addition to rating various aspects of the tool on a scale, participants provided many useful suggestions via open-ended comments. The Panel gave S.O.S. high scores (4.1; n = 11) on the intuitiveness of searching with the Strategy and Lesson Generators (1 = not intuitive; 5 = very intuitive). They gave an even higher score (4.4; n = 11) on the usefulness of the “related resources” which included videos, lesson plans, graphics, etc. Such resources are intended to help clarify, enrich, or reinforce the teaching strategies suggested by the strategy generator.

In terms of quality of video, most comments reflected high enthusiasm for the videos. “This is some of the highest quality [video] I have seen on the web!!!” wrote one respondent. Another wrote: “It is always valuable to hear from colleagues. When I see the enthusiasm of the person in the video, it makes me more likely to try their strategy. The videos are a valuable part of S.O.S.” There were some comments, however, that indicated concern about the speed of access of the videos. Some of the longer videos took an extremely long time to load if the user did not have a direct connection to the Internet.



Figure 1: Screen capture showing top half of homepage illustrates interface design of 2nd iteration prototype



Figure 2: Screen capture from selected video depicting current frame size in relation to page.

Participants commented that the voiceovers which were added to some of the videos were of professional quality, helped to clarify points made by the speaker (educator), and were effective in providing transitions.

After seeing two examples demonstrating an alternative video production technique, almost all Panel members agreed that allowing educators to submit photos that could be edited into a video with a voiceover added would provide a valuable alternative to all motion video. An important point was made that many educators still feel more comfortable with a still camera than a video camera. Finally, the opinions were mixed on the value of including video transcripts but one important comment was made that transcripts may be useful for the hearing impaired.

Some Panel members felt the current size of the video frame used in the prototype was

adequate; others felt it should be twice as large. Figure 2 illustrates the current frame size in relation to the page. The user arrives at the screen in Figure 2 after selecting a particular video from the list of Related Resources (to the strategy or lesson plan) which includes brief descriptions of the available videos. As technology advances allow, we anticipate increasing the size of the video at least two-fold. We selected the current size in order to conduct research with users who would not have been able to accommodate the larger video size at this time due to unreasonable loading times.

Comments were solicited on the usefulness of the search function for information literacy standards. This search is based on the national standards as presented in *Information Power, Building Partnerships For Learning* (1998). Responses were generally positive and included: “This is a good search. Often we are looking for a specific idea to teach a standard required in our curriculum and this will be a good resource for it.” Another wrote: “This will be handy when my co-librarian and I are in the midst of our curriculum and benchmarks we are writing based on the ILS [information literacy standards] from *Information Power*. Great examples.”

The user can select one of the broader standards or narrow the search to include only those lessons that relate to a specific indicator of the standard. Future development will broaden the search to include all video and related resources as well.

Although not implemented in the prototype, participants were asked to assess how useful it would be to search S.O.S. by nationally recognized content area standards such as those compiled by the Mid-Continent Research for Education and Learning (McREL) in addition to searching by information literacy standards. On a scale of 1 (not useful) to 5 (very useful), this item received a 3.7. One Panel member wrote: “I believe the national standards are adequate. Users can interpolate where the standard they are looking for is within the national standards.”

Panel members offered suggestions for improving the Topic Search function including providing drop-down menus of topics, clarifying directions, providing the ability to browse available topics, and adding a help menu. Positive comments included those who liked the “quickness” and “ease” of the search in addition to its potential helpfulness in searching for ideas to integrate into classroom instruction.

From a design and navigational perspective, S.O.S. was well received. It had received a complete overhaul from the simple design and layout of the initial prototype beta tested by the Focus Group. Panel members commented positively on the colors, banner, the appealing look, and layout. One member wrote: “I love the design and colors used in the site . . . the way the menu buttons move is great! I like the logo of the earth and the banner. Information is shared all over the world.” That is the message that the banner was meant to reflect and it seemed to be readily recognized.

Finally, comments from both the Focus Group and the Faculty/Leaders Questionnaire had previously mentioned the desirability of including a section where visitors could find news, features, special videos, or other information. This was included in the 2<sup>nd</sup> prototype iteration which the Progressive Feedback Panel reviewed. The “Spotlight” section of the site was enthusiastically accepted. Responses were almost universally positive. One person commented on its potential value for encouraging collaboration which is one of the project’s underlying goals. “*In the Spotlight*” for this prototype included a feature story on a teacher from New Hampshire who cleverly wove eight information skills into a 6-week Social Studies unit on communities. In fact, her students actually built a play community in the woods behind their school as a way of learning the concepts. Also “*In the Spotlight*” was a library media specialist talking about ways to foster collaboration between classroom teachers and library media specialists. This was presented as a video interview. This component of S.O.S. will help the site maintain a current feel and may be expanded in future development efforts.

### From Phase I to Current Development

Creative Media Solutions, Inc. is continuing to develop *S.O.S. for Information Literacy* through a strategic alliance with Grant Systems, Inc., as new sources of funding are explored. Since the authors have always planned on making this resource freely available to educators, creative means of sustaining the project are necessary.

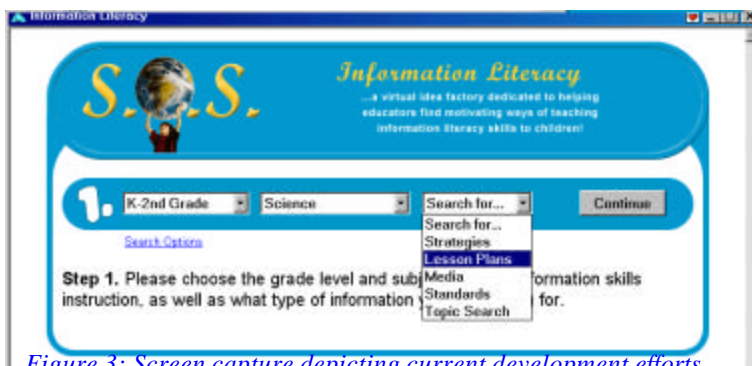


Figure 3: Screen capture depicting current development efforts to produce streamlined searches and simplified design

Already, a number of improvements have been accomplished as a result of the input from the Phase I research. Search screens are now much more streamlined and require no scrolling. After selecting grade levels, subject area, and type of search (see

Figure 3), for example, the user can select both information skill(s) and subskill(s) in one easy step. The color scheme, considered pleasant (blue and gold tones) by the Progressive Feedback Panel, has been retained but the screen design has been simplified. An online submission template which will allow educators to upload media such as digital stills and PowerPoint presentations along with their lesson plans is currently being developed. As soon as completed, library media specialists and classroom teachers will be recruited to submit materials to populate the database. Once the database has sufficient materials for meaningful queries, it will be made available to educators at large.

Evaluation of all materials submitted to the database will be an important aspect of S.O.S. Before being made available online, new submissions will be reviewed by a two-person team of evaluators using an evaluation rubric similar to that used in the U.S. Department of Education's Gateway to Educational Materials (GEM) project. A Web-based interface for evaluators to review and score submissions is currently being developed.

Finally, the *S.O.S. for Information Literacy* information system will be expanded to include middle school grades.

### **Summary**

The successful completion of all technical objectives for Phase I not only demonstrated the project's feasibility but also provided a strong framework for the successful continuation of the research and development effort. Most importantly, there was a high degree of agreement by educators in each of the research components conducted that *S.O.S. for Information Literacy* would be a valuable and needed addition to improving the teaching of information literacy at the elementary and middle school grade levels.

# Online Resources for Teaching Widely-Used Secondary School Texts

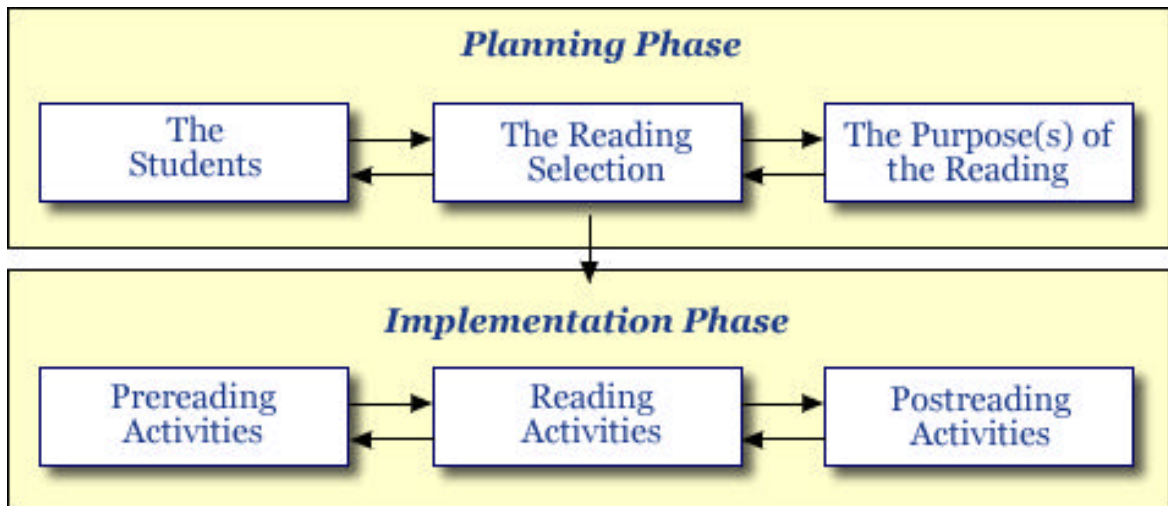
Thomas J. Reinartz  
Lauren A. Liang  
*University of Minnesota*

Gregory C. Sales  
*Seward Learning Systems, Inc.*

## Scaffolded Reading Experiences

The scaffolded-reading-experience (Graves & Graves, 1994, Tierney & Readence, 2000; Watts & Rothenberg, 1997) instructional framework provides both lesson designers and lesson users with a flexible structure for text-specific lessons. This framework presents a set of options for creating coordinated sets of pre-, during-, and post-reading activities (Figure 1). While the framework is appropriate for various combinations of texts and purposes, the specific activities employed in any particular situation will differ greatly depending on the difficulty of the reading selection and the purposes for which students are reading.

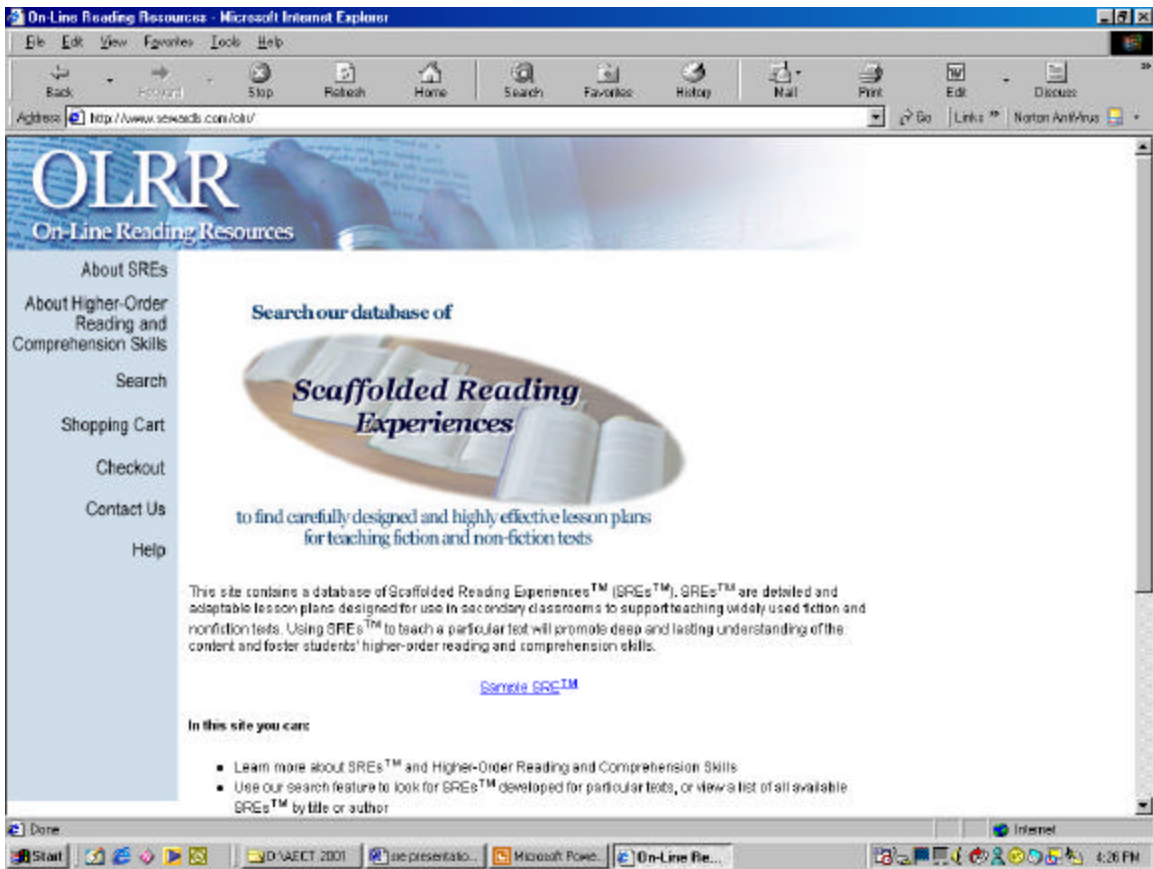
Figure 1



Method Used in Constructing the Website and Scaffolded Reading Experiences The website (Figure 2) was constructed by professional design and development staff at Seward Learning Systems, Inc. (SLS), using standard web development tools and procedures. A designer, a subject-matter expert, a graphic artist, and a programmer worked as a team to develop the website. The scaffolded reading experiences (SREs) were created by two secondary teachers; university faculty members in literature, social studies, and reading education; and a research assistant. This team used the SRE instructional framework as a model for the instruction.

Figure 2





## Methods of Evaluating the Website and SREs

The website and the SREs themselves were evaluated by 10 high school English teachers and 10 high school social teachers. Half of these teachers were observed and interviewed by the project staff as they worked on the website and completed a written survey. The other half of the teachers completed only the written survey.

Two SREs were evaluated in high school classrooms. In one school, three 10th grade classes read and studied *The Great Gatsby* over a three-week period. Because of a last-minute school decision that different classes not receive different activities, all three classes used the SRE. All three classes also received pretests and posttests on knowledge about *Gatsby* and higher order thinking skills as well as a posttest in which they demonstrated higher order thinking with *Gatsby*.

In the other school, two 12th grade classes read and studied *Hamlet* over a three-week period. Here, we conducted a mini experiment, with one class receiving the SRE and the other class receiving the teacher's typical instruction. These two classes received pretests and posttests paralleling those given to the classes that read *Gatsby*.

## Data Sources for Evaluating the Website and SREs

The data for evaluating the website and SREs were the field notes taken by the researchers as teacher-reviewers were exploring the website and SREs and the results of the written survey. The data for evaluating the effectiveness of the SREs were the results of the pretests and posttests administered to students who read *Gatsby* and those who read *Hamlet*.

## Results with Respect to the Website and SREs Constructed

The website included five major pages:

- **About SREs** - approximately 1000 words in length. It explains what SREs are, the SRE framework, the possible components of an SRE, and the content and organization of each SRE.

- **About Higher-Order Reading and Comprehension Skills** - approximately 1300 words in length. It includes a definition of higher order thinking (Resnick,1987), a description of analytical, creative, and practical thinking (Sternberg,1996) and a discussion of teaching for understanding (Perkins, 1998,1992). This section also includes a link to the Center for Critical Thinking (<http://www.criticalthinking.org/default.html>), which includes an extensive discussion of critical thinking and definitions and examples of the types of higher order thinking skills emphasized in the SREs
- **Search** - allows users to search the site by Author, Title, and Topic (all open fields), as well as by Type of Text (Fiction, Non-Fiction, Poetry, Drama), Ethnic Group Featured (Black, Asian or Pacific Islander, American Indian or Alaskan Native, Hispanic, White), and Grades (9-10, 11-12, 13-14).
- **Contact Us** -
- **Help**-

During the Phase I development the site was populated with the following six SREs:

- James Baldwin's "Sonny's Blues," (1948)
- William Faulkner's "A Rose for Emily," (1930)
- F. Scott Fitzgerald's *The Great Gatsby*, (1925)
- Russell Freedman's *Eleanor Roosevelt*, (1994)
- Shakespeare's *Hamlet*,( c. 1600)
- United Nations' *Universal Declaration of Human Rights*, (1948)

Each SRE was comprised of the following component:

- Introduction
- Table of Contents
- Objectives
- Higher Order Reading and Comprehension Skills Emphasized
- Chronological List of Activities
- Detailed Description of Activities
- Student Materials
- Resources

Thus, once a user is familiar with the organization of one SRE, she is familiar with the organization of all of them.

## Evaluation Results

Observations and interviews with the 10 English teachers showed a very favorable attitude toward the site. The most valued features were (1) that teachers could modify the material, (2) the inclusion of student materials, and (3) the teacher resources, which included online resources. Teachers also commented that the search capabilities would be very useful once the website included a large number of SREs. Observations and interviews also revealed that the site generally functioned well.

The most consistent responses on the survey were that (1) shorter descriptions of the website would be desirable, (2) more graphics on both the website and the SREs would be desirable, and (3) having as many teacher resources as possible would be useful.

Tests of the 10th graders comprehension of *Gatsby* showed that on the pretest only 16 percent of the students had any knowledge about the novel and that no students could name any themes from the novel. On the posttest 96 percent of the students gave an acceptable or strong summary of the novel, and students named an average of 2 themes from the novel.

Tests of the 10th graders knowledge of higher order skills showed that on the pretest only 7 percent of the students had any knowledge about higher order thinking and no students could describe any of the three main types of higher order thinking. On the posttest, 84 percent of the students gave an acceptable or strong definition of higher order thinking, and students named an average of 2 of the three main types of higher order thinking. Additionally, on the posttest 72 percent of the students were able to use the higher order skills they had been taught to interpret a previously unread passage from the novel. (See Table 1.)

*Pre and Post Test Means for The Great Gatsby SRE*

Item	Pre-test	Post-test
Summarize the plot in three paragraphs or less.	0.0	2.3
Identify as many significant themes in the novel as you are familiar with.	0	1.7
Define Higher Level Thinking.	0	2.3
List the three main types of Higher Level Thinking.	0	1.7
Define Analytical Thinking.	.1	2.3
List three Analytical Thinking Skills.	0	1.9
Identify the section on pages 188-189 in which Nick makes these final comments by giving the beginning 4-5 words and the ending 4-5 words.	-	2.2
Select a sentence of phrase from that section that you find particularly informative about Gatsby. (2x)	-	3.7*
Explain what this sentence of phrase tells us about him. (2x)	-	2.8*

Table 1

**Educational Importance of the Study**

Everything we have learned thus far supports the feasibility of putting these online resources on the Web so that at least some of the time teachers can begin with quality basic lesson plans and spend their very limited time modifying, improving, and tailoring the lessons to their students rather than doing basic lesson design. Doing so should result in a huge saving of time and in better lessons.

**References**

Graves, M. F., & Graves, B. B. (1994). Scaffolding reading experiences: Designs for student success. Norwood, MA: Christopher-Gordon.

Perkins, D. (1992). Smart schools: From training memories to educating minds. New York: The Free Press.

Perkins, D. N., & Tishman, S. (1998). Dispositional aspects of intelligence. Available: <http://learnweb.harvard.edu/alps/thinking/docs/Plymouth.htm>

Resnick, L. G. (1987). Education and learning to think. Washington, D. C.: National Academy Press. The complete, searchable text is available at <http://books.nap.edu/catalog/1032.html>.

Rothenberg, S. S; & Watts, M. (1997). Students with learning difficulties meet Shakespeare: Using a scaffolded reading experience. Journal of Adolescent & Adult Literacy, 40, 532-539.

Sternberg, R. J., & Sperling, L. S. (1996). Teaching for thinking. Washington, D.C.: American Psychological Association

Tierney, R. J., & Readence, J. E. (2000). Reading strategies and practices: A compendium (5th ed.). Boston, MA: Allyn & Bacon.

# Web-Based Training and Corporate America

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## Introduction

Advances in technology offer the possibility of new methods for delivering instruction. Learning via the Internet is being heralded by many as the new pedagogical model for training. Recent issues of training, computer, and management magazines all suggest that web-based training (WBT) is the best way to reach geographically dispersed employees quickly and at low costs. Some articles offer examples of companies that have successfully implemented WBT. However, the same articles that tout WBT as the next wave in the instructional technology revolution often fail to provide the reader with specific, instructionally sound steps for implementing WBT in a corporate setting.

Furthermore, many companies eager to embrace WBT have focused their attention on the features of the new technology. The trainers and/or instructional designers who fall into this trap expect WBT's features alone to provide effective instruction (Alexander, 1995). As a result, the advantages that WBT offers are often overshadowed by poor design and cumbersome navigation (Cohen & Rustad; 1998; Filipczak, 1997b; Henke, 1997; Strandberg, 1999). Learners are set adrift in cyberspace with little or no instruction.

The purpose of this paper is to explore the many unique characteristics of WBT and to discuss important issues related to the use of WBT in a corporate setting. These issues include the cost effectiveness considerations of using WBT, the design, implementation and delivery of WBT, and the impact that WBT has on both learners and trainers. Examples of how WBT is being used in American corporations will be introduced, too.

## WBT

WBT refers to the communication of information over the World Wide Web (WWW) with the intent of providing instruction (Kurtus, 1997). WBT makes it possible for students, the instructor, the course content and, at times, professional groups and subject matter experts, to be in different locations at possibly different times and yet still be brought together through the use of on-line technology (Dede, 1996; Heckman & Owens, 1996; McIntyre, 1996; Saltzberg & Polyson, 1996; Smith, Tyler & Benscoter, 1999; Stenerson, 1998; Williams, 1998). WBT allows learners who cannot have face-to-face training to attend classes in their homes or offices through the use of the Internet or a company's intranet (Henke, 1997; Levin, Levin & Waddoups, 1999).

WBT uses Web technologies, such as, Web browsers including Microsoft Internet Explorer or Netscape Navigator, Hypertext Transfer Protocol (HTTP), Transmission Control Protocol/Internet Protocol (TCP/IP) protocols, and Hypertext Markup Language (HTML) as its programming language. HTML is a language that allows computers linked to the Internet to transfer information to one another, thus enabling the computer to retrieve all or just parts of the information located on a Web site (Hall, 1997; Polyson, Saltzberg & Godwin-Jones, 1996; Rutherford, 1996). By using HTML, the learner can explore additional resources in other web sites in the order and at the pace that he or she prefers. This experience, for most WBT learners, is similar to staying after class to talk with other students or the instructor.

WBT can be synchronous or asynchronous. Synchronous training is instantaneous and allows the instructor and learners to interact via the Web in "real-time" (Driscoll, 1998; Kruse & Keil, 2000). This can be accomplished through on-line discussions, real-time audio, videoconferencing, and application sharing where two or more people can work on the same file, such as a shared electronic whiteboard or a spreadsheet, simultaneously. In contrast, asynchronous training is not instantaneous; the learner logs on to the course to complete the lesson or post, receives and responds to messages at his or her own pace and at the time that is convenient to him or her (Bearman, 1997; Driscoll, 1998; Kruse & Keil, 2000). In using either type of WBT, it offers learners a higher degree of anonymity, as compared to face-to-face instruction. The anonymity enables the learner to interact with other learners in an environment free from bias or discriminations due to age, gender, economic status, or appearance differences.

In theory, any type of content can be presented via WBT (Beer, 2000; Driscoll, 1998). For example, WBT can be a good venue for presenting verbal information. WBT is also appropriate for delivering instruction related to concept and rule learning and problem solving skills. However, motor techniques and attitudinal skills are not well

suited to WBT. This is due to the limitations of WBT in allowing the learner to practice the sequence involved in mastering the motor skills as well as procedures required for attitude or behavioral changes.

### **The Status of WBT in Corporate America**

Many corporations now use some form of WBT to deliver training. According to a Fortune magazine survey, corporations in year 2000 spent approximately 20% of the \$66 billion allocated for training annually on WBT (Gotschall, 2000). That percentage is expected to increase to 40% by the year 2003. In addition, a report provided by Masie in 1997 stated that in 1997 alone, 71 percent of major U.S. companies had an objective of using their intranets to pilot the delivery of corporate training presentations. Masie also reported that major software publishers, including IBM and Microsoft, are working on online learning and training products and services. Companies who published multimedia authoring tool companies like Macromedia and Allen Communications, are also building Web delivery capability into its products. Finally, Masie detailed that the majority of classroom-based training companies, such as CBT Systems and Gartner Group, has begun to establish online learning products (Anonymous, 1997).

Other corporate examples in using WBT include, PricewaterhouseCoopers, a consulting firm, is introducing a new learning technology called Continua. This technology allows employees to form virtual professional communities based on areas of interest, abilities, or client relations. Services such as peer dialogue, chat groups, online events, and online training are part of Continua (Koonce, 1998). In addition, in a recent study by Hall, it is reported that the Cisco Systems had the most pervasive e-learning implementation (Hall & LeCavalier, 2000). Cisco Systems offers some form of WBT in all 30 of its training organizations, with its major emphasis on sales training. However, Cisco itself notes that it uses WBT to deliver only 5% of its total training ("Learning on Demand").

Siemens Business Communications launched Siemens Virtual University (SVU) in 1997 and now offers more than 64 courses, from Local Area Networks and Wide Area Networks (LAN/WAN) technology to customer relations, to its 7,500 employees worldwide (Frieswick, 1999). Dell Computer Corporation aggressively pursued Web-based training as a solution to its employee education needs (Cone, 2000; Galagan, 2000). The company patterned its training after its business model, which emphasizes a direct-to-customer approach, with on-line training available 24 hours a day, 7 days a week. Dell's Vice President of Learning, John Cone, expects 90% of its courses to be delivered online by 2001. In 1998, Dow Chemical, headquartered in Midland, MI, began the process of converting its 700,000 employee-hours of industry-related training into Web-based training modules (Barron, 1999a). It anticipates that by the end of 2001, it will offer more than 60 courses via WBT, representing three-quarters of its industry-related training and an additional 300,000 hours of employee-development training.

In addition, IBM, Xerox, Siemens Business Communications and Eli Lilly Corporation employ a combination of individual assignments coupled with group discussions and projects in their WBT courses (Frieswick, 1999; Hibbard, 1998; "IBM builds its manager training," 2000; "Siemens saves \$2000," 2000). Most of these courses are asynchronous. Only Chrysler, Herman Miller, Siemens Business Communications and Aetna offer real time learning to their employees (Barron, 1999a; "Herman Miller turns," 2000; Hibbard, 1998).

The topics most commonly taught via WBT are company-specific procedures and products. Southern California Edison, Siemens Business Communications, Xerox, Herman Miller, Dow Chemical, General Motors, Ford Motors, Cisco Systems, Eli Lilly, and Dell all use WBT to train employees on company-specific processes and products (Barrett & Lewis, 2000; Barron, 1999a; Beer, 2000; Frieswick, 1999; "Herman Miller turns," 2000; Hibbard, 1998; "Southern California Edison uses," 2000; "Smarter sales force," 2000). Technology-based courses, such as software programs or how to navigate the Internet, appear to be second to product and processes in course offerings. Dell, Microsoft, KPMG, Charles Schwab and Siemens Business Communications all offer technology-based courses to their employees (Balu, 2000; Dobbs, 2000b; Frieswick, 1999; Gotschall, 2000; Hall, 1997). Dell and Xerox also offer an orientation program to new employees via WBT (Beer, 2000; Cone, 2000) and Dell and IBM offer management courses via WBT (IBM builds its manager training, 2000).

### **Important Considerations of Using WBT in Corporations**

A company must consider many factors when deciding whether or not the move to WBT would be cost effective. These factors are explained as follows.

#### **Considerations of Cost Effectiveness**

The first consideration is the cost that a company will spend on equipments, for delivering WBT courses. Normally, a Web server dedicated to supporting the materials can range from less than \$5,000 to more than \$100,000 (Beer, 2000; Hall, 1997) and in some cases, may also require an access license fee for each user (Wells, 1999). Companies may also need to pay for special “plug-in” software for special features, such as video, animation, and sound.

Companies also need to consider if they could afford allocating internal resources to create WBT courses. Normally, it would take between 100 – 200 hours to develop one hour of on-line instruction (Beer, 2000; Frieswick, 1999). For some companies, it may be more practical to contract with an outside vendor to develop the WBT courses. Most WBT design vendors charge anywhere from \$7,000 to \$50,000 per finished hour, depending on the course’s complexity and use of multimedia plug-ins (Hall, 1997; Kruse & Keil, 2000). Consequently, whether the WBT is developed internally or externally, companies can spend thousands of dollars on the development stage. In addition to the development of WBT, maintaining the course is another issue. Maintenance costs often include revisions to the course and subsequent Web site maintenance (Beer, 2000; Hall, 1997; Kilby, 1997; Sanders, 1998). Web server maintenance and course upgrades can cost upwards of \$500,000 per year.

Furthermore, how a WBT course will be used also affects a company’s overall investment considerations. For example, a course that will be delivered once or twice, then abandoned, is not a good candidate for WBT (Kruse & Keil, 2000). Companies must consider the total number of learners who will be using the course and consider if the course can help reducing the amount of time the learners will be pulled out from their regular jobs.

However, while initial costs for WBT can run anywhere from \$75,000 to \$1.6 million (Barron, 1999a; Frieswick, 1999), Hall (1997) asserts that WBT “reduces the cost of training when compared to instructor-led training...primarily from a reduction in training time and the elimination of travel” (p. 108). Wells (1999) also emphasized that the initial costs to implement WBT are often offset by the long-term gain in employee productivity. By using WBT, companies can train a larger number of employees in a shorter time frame and at reduced costs when the materials are delivered via WBT (Barron, 1999a; Beer, 2000; Driscoll, 1998; Hall, 1997; Salopek, 1998; Wells, 1999).

For example, Hewlett Packard reports that WBT has reduced its new sales representative training from 20 weeks to eight days per year (Reinhardt, 1995). Hewlett Packard estimates saving \$800,000 per year since its use of WBT. Before using the Web, Hewlett Packard must budget travel expenses both for its trainees and trainers, and must spend money on renting many convention centers in different cities for its sales training. Additional examples include, Aetna U.S. Healthcare estimates that it saved \$3 million in travel and associated costs the first 18 months of its on-line training programs (Barron, 1999a). Steelcase, the largest office furniture manufacturer in the United States, has cut its training costs by 30% through the use of Web-based training (“Steelcase to save resources,” 2000). Siemens Business Communications estimates that WBT has saved the company \$4 million in travel costs alone (Frieswick, 1999) while IBM estimates that for every 1000 employees who use WBT, the company saves \$500,000 in travel-associated costs (Kiser, 1999). MCI estimates that it realized a savings of \$2.8 million in reduced travel, facility and labor costs in a 20-month period after the introduction of WBT (Neilson, Pasternack & Viscio, 2000). Rockwell Collins, a company that manufactures cockpit instruments, estimates that its newly-implemented WBT delivery system will save the company \$14 million in three years in travel costs alone (Fister, 2000). Price Waterhouse realized an 86% cost savings using WBT over traditional classroom delivery (Hall, 1997). Dow Chemical estimates its \$1.6 million WBT start-up costs are yielding a return of \$4-\$5 million annually (Barron, 1999a). And, Budget Rent-A-Car reduced its per employee cost from \$2000 to \$150 by placing its new employee training on the Web (Schaaf, 1997).

### **Considerations for Course Consistency and Delivery**

Other factors that a company needs to consider when using WBT include, if the course content need to stay consistent over time, and if the course need to be delivered to the learners instantly. If the answers to these questions are “yes”, WBT would be a good choice. WBT offers a higher level of content consistency that is difficult to be attained by human trainers. It can also prevent from a course being changed in re mote offices. In other words, companies can use WBT to provide standardized training for all trainees regardless of different locations or instructors (Reinhardt, 1995). WBT can also provide instant distribution of the course content. The content of most WBT can be updated instantly, which is not possible with any other educational technologies. Technologies such as CD-ROMs, printed materials, floppy disks, videos, etc. must be mechanically reproduced, then mailed to the learners. With WBT materials, the designer simply has to send the course material or updates to the server and it will be available to the learner instantly (Driscoll, 1998; Hibbard, 1998; Kruse & Keil, 2000; Sanders, 1999; Staley, 1999).

## **Considerations of the Bandwidth Limitation**

One of the frustrations related to the use of WBT in many corporations is the bandwidth limitation. Bandwidth determines how much information can be sent across the web and how fast it will be sent (Filipczak, 1997a; Hall, 1997; Schaaf, 1999a; Williams, 1998). Bandwidth problems translate to slow transmission and delayed response time for learners. Learners may become frustrated and bored when response time is very slow (Kiser, 1999; Kurtus, 1997).

Bandwidth can become an issue in one of three places: the originating computer, the “pipeline” over which the information is sent (in most cases, a telephone line), or the receiving computer. The most common bandwidth problems focus on the “pipeline.” The “pipeline” refers to the data-carrying capacity of the computer-to-computer delivery channel. Common pipeline sizes range from relatively small 28.8 kilobytes per second (kbps) modems to optical fiber that can handle more than 10 gigabytes (gbps) per second. The problem of pipeline capacity arises when designers add data-intensive multimedia such as videos, complex audio, live transmissions, and animation to WBT programs (Bassi et al., 1998; Filipczak, 1997a; Kurtus, 1997; Schaaf, 1999a; Schaaf, 1997; Williams, 1998). The increasing use of the Internet also adds to bandwidth problems (Bassi et al., 1998; Schaaf, 1997). In 1996, bandwidth demand was approximately 200 trillion bits per day (bpd). This figure is expected to rise to 9,000 trillion bpd as early as 2001 and to 220,000 trillion by 2006, creating the potential for a network overload.

However, bandwidth problems can be lessened by creating separate, smaller programs that are executed within the primary application (“Applets,” 2000; Beer, 2000). These smaller programs, called applets, are designed to be downloaded from the Web and launched by the primary application to support simulations and other media-intensive applications without adding to the size of the primary program. For example, the designer or programmer could create a master file that contains the rules and programming language necessary to run all simulations. The master file is then stored separately from smaller files that contain information specific to individual simulations. When a simulation is started, both files are used, but because they are stored separately, the download time is faster than when all the information is stored in one large file. Recently introduced Digital Subscriber Lines (DSL), satellite transmission systems and cable modems are becoming the alternatives to slow dial-up modems and bandwidth limitations (Bassi et al., 1998; Wiley, South, Basset, Nelson, Seawright, Peterson & Monson, 1999). These technologies offer users the ability to connect to the Web via standard telephone lines and receive data at rates considerably higher than 33.6 kbs. However, because DSL and cable modems use shared data pathways, increased use of these technologies eventually will result in reduced transmission speeds.

## **Considerations of Learners’ Technical Skills**

One of the more challenging obstacles when implementing WBT is the learner's lack of computer and/or Internet skills (Wulf, 1996, p. 54). For many organizations, this could mean additional technical training. In addition, employees with limited technical background and skills may feel apprehensive and confused. They may resist WBT training. Another possible drawback of using WBT is that the organization must rely on the individual to take initiative with his or her own WBT training (Wulf, 1996, p. 54). With WBT, although the company does not need to require an employee to be at a certain place at a particular time, however, the company must communicate with employees regarding when and where they will be trained and the level of participation.

## **Other Considerations**

In addition to the above considerations, other considerations include security, the changing role of the trainer and the training department, and the impact of digital relationships. Security has become a growing concern. Since the Internet was originally designed as a private network for the military and for educational use, at that time, security was not a problem. With the growth of businesses on the net, the need for security has become greater with a public network (Keen, Mougayar, & Torregrossa, 1998).

There is also a concern regarding the skills and resources needed by the traditional trainer and training department if the organizations focus shifts to training via the Web. This is especially true since close to 50 percent of training departments are composed of classroom trainers (Appleton, 1998, p. 1). For example, the online instructor does not have the same type of control over a group of learners as they would in a typical classroom environment. The instructor must become more of a facilitator or moderator (Kearsley, 1997). Additionally, an online trainer in an environment that does not incorporate video is limited by not being able to see the learners. By seeing the learners, an instructor can gauge attention levels and comprehension of material. The trainer must ensure that the learners interact. They can do this by monitoring chat rooms, virtual white boards, etceteras (Snell, 1998).

The focus of training departments may become more centered on using Internet tools to develop, deliver, and monitor online training digitally, as opposed to developing and delivering classroom training.

Finally, there is concern regarding the impact of the prolonged exposure of learners and instructors to digital environments (Stone, 1996), as well as the formation of digital relationships versus the traditional development of relationships (Murphy, 1996). Some also feel that with the loss of face-to-face interaction, behavioral, gestures, and tonal cues may cause misunderstanding (Pennell, 1996).

### **Organizational Implications in Using WBT**

The first implication is related to the function and skills of trainers or instructional designers of a company. While developing WBT courses, corporate trainers or instructional designers need to be proficient in skills that are not normally associated with classroom or face-to-face instruction design (Alexander, 1995; Beer, 2000; Curtin, 1997; Dobbs, 2000b; Hall & LeCavalier, 2000; Horton, 2000). They now need to possess a thorough understanding of HTML, computers, networking, and Internet protocols in order to incorporate materials that are Web-compatible. Clearly, the Web is a largely visual medium; it would be helpful for corporate trainers to be proficient in graphic design and layout. It would be also helpful for the trainers or designers to have an artistic perspective and a basic understanding of ratio aspects.

The second implication concerns the relationship between the Training department and the Information Technology (IT) department. Clearly, as a company moves to WBT, the Training Department needs technical support from the IT department (Curtin, 1997; Driscoll, 1998; Filipczak, 1997a; Hall & LeCavalier, 2000; Kiser, 1999). The two departments now must work together to ensure that WBT does not create a drain on the company's network, servers and IT Help Desk.

One result of this collaboration will be that trainers and/or the instructional designers instructional designers will have a better understanding of the technology used for WBT, and the IT professionals will benefit from an increased understanding of instructional design process.

Finally, the last implication is about merging working and learning among employees. As WBT becomes more commonplace in organizations, companies will find more ways to integrate it into employees' everyday work lives (Beer, 2000; Cone, 2000; Driscoll, 1998; Ryan, Neece & Meyer, 2000). Employees will have WBT available as a means of quick reference at their desktops. They will be able to access a WBT course, or a small piece of it, to seek the information they need. Employees will come to expect instantaneous information and to access to subject matter experts as a way of doing business. Employees will eventually become so used to the process of receiving information "just-in-time" without even realizing that they are learning while working.

Reload buttons should be available to make the learner's navigation through the course easier (Kruse & Keil, 2000). In addition, page transitions should be simple and speedy to avoid long download times and subsequent learner frustration (Curtin, 1997; Williams, 1998). Every page should include a link to the course's home page to allow a "lost" learner to find his or her way back to the course easily (Nielsen, 1996). Multimedia should be avoided because of download time constraints, unless it is critical to the learning process (Beer, 2000; Clark & Lyons, 1999).

Finally, storyboards for each WBT module are strongly recommended for designing and revising purposes (Driscoll, 1998; Hall, 1997; Kruse & Keil, 2000; Ward, 1998). Storyboards are visual representation of the information that will be included on the screen. One storyboard should be created for each screen, and it should include thumbnail sketches of all onscreen visuals and the corresponding text. Storyboards should include identifying information, such as the course title, the date, the version or draft number, and the page number. It will also specify the names of the files (audio, video, graphic) to be used, file numbering schemes, programming notes, and branching instructions.

### **Conclusion**

WBT is time and location independent and thus enabling companies to train their widely dispersed employees without incurring exorbitant travel cost. Employees are also allowed to have a higher level of flexibility while taking a WBT course. However, technical and design issues present obstacles to the effective use of WBT in many corporations. It is imperative that WBT is grounded in learning theories and instructional design principles. Effective WBT must also engage employees and provides them with opportunities to apply the gained knowledge and skills back to their jobs.



## References

- Alexander, S. (1995). Teaching and learning on the World Wide Web. Retrieved November 14, 1999 from the World Wide Web: <http://elmo.scu.au/sponsored/ausWeb/ausWeb95/papers/education2/alexander/>
- Applets. (2000, February 19). Retrieved August 7, 2000 from the World Wide Web: <http://webopedia.internet.com/TERM/a/applet.html>
- Balu, R. (2000). KPMG faces the internet. *Fast Company*, 32(50). Retrieved April 27, 2000 from the World Wide Web: <http://www.fastcompany.com/online/32/kpmg.html>
- Barrett, C. & Lewis, D. (2000). Reusable learning object strategy. Retrieved October 28, 2000 from the World Wide Web: [http://www.cisco.com/warp/public/10/wwtraining/elearning/learn/whitepaper\\_docs/rlo\\_strategy\\_v3-1.pdf](http://www.cisco.com/warp/public/10/wwtraining/elearning/learn/whitepaper_docs/rlo_strategy_v3-1.pdf)
- Barron, T. (1999). Harnessing online learning. *Training and Development*, 53(9), 28–33.
- E-Bassi, L., Cheney, S. & Lewis, E. (1998). Trends in workplace learning: supply and demand in interesting times. *Training and Development*, 52(11), 62–66.
- Beer, V. (2000). The web-learning field handbook: using the world wide web to build workplace learning environments. San Francisco: Jossey-Bass Pfeiffer.
- Bearman, Margaret. (1997). Why use technology? Retrieved November 20, 1998 from the World Wide Web: <http://www.monash.edu.au/informatics/teachme/whyuse.htm>
- Cohen, S. & Rustad, J. (1998). High tech, high touch, high time? *Training and Development*, 52(12), 31–37.
- Cone, J. (2000). How Dell does it. *Training and Development*, 54(6), 58–70.
- Curtin, C. (1997). Getting off to a good start on intranets. *Training and Development*, 51(12), 41–46.
- Dede, Chris (1995). The transformance of distance education to distributed education. Retrieved November 14, 1999 from the World Wide Web: <http://www.hbg.psu.edu/bsed/intro/docs/distlearn/index.html>
- Dobbs, K. (2000). Who's in charge of e-learning? *Training*, 37(6), 55–58.
- Driscoll, M. (1998). Web-based training: using technology to design adult learning experiences. San Francisco: Jossey-Bass Pfeiffer.
- Filipcak, B. (1997a). Are you wired enough? *Training*, 34(12), 25–39.
- Filipcak, B. (1997b). Training gets doomed. *Training*, 34(12), 25–31.
- Fister, S. (2000). Reinventing training at Rockwell Collins. *Training*, 37(4), 64–70.
- Frieswick, K. (1999). The online option. *CFO*, 15(12), 89–92.
- Galagan, P. (2000). Getting started with e-learning. *Training and Development*, 54(5), 62–64.
- Gotschall, M. (2000). E-learning strategies. Retrieved October 28, 2000 from the World Wide Web: <http://www.fortune.com/fortune/sections/onlinelearn/onlinelearn.htm>
- Hall, B. (1997). *Web-based training Cookbook*. New York: John Wiley & Sons, Inc.
- Hall, B. & LeCavalier, J. (2000). The benchmarking study of best practices. *e-learning*, 1(4), 27–41.
- Heckman, B. & Owens, D. (1996, January). Pedagogical contributions of education environments: the traditional classroom, computer-based learning and the world wide web. Paper presented at the meeting of the American Meteorological Association, Boulder, CO.
- Henke, H. (1997). Evaluating web-based instructional design. Retrieved November 14, 1999 from the World Wide Web: <http://scis.nova.edu/~henkeh/story1.htm>
- Herman Miller turns to Learning Space 4.0 to train its dealers. (2000, May 15).
- Lotus Development Corporation. Retrieved May 25, 2000 from the World Wide Web: <http://www.lotus.com/news/news.nsf/public/A1C2BEB10E2CD738852568E00042CDE8>
- Hibbard, J. (1998, March 9). The learning revolution. *Information Week*, (672), 44–60.
- Horton, W. Instructional design for online learning. *Getting started with online learning*. Retrieved from the World Wide Web on October 28, 2000: <http://www.macromedia.com/learning>
- IBM builds its manager training program with Learning Space 4.0 Lotus Development Corporation. Retrieved June 27, 2000 from the World Wide Web: <http://www9.software.ibm.com/mindspan/distlearning.nsf/wdocs/5EE5DODC064CAD03852568DA00655551?OpenDocument>
- Kilby, T. (1997). *What is web-based training?* Retrieved November 1, 1999 Web-based training Information Center database: <http://www.filename.com/wbt/pages/htm>
- Kiser, K. (1999). 10 things we know so far about online training. *Training*, 36(11), 66–74.
- Koonce, R. (1998). Where technology and training meet. *Technical Training*, 9(6), 10–15.

- Kruse, K. & Keil, J. (2000). Technology based training. San Francisco: Jossey-Bass Pfeiffer.
- Kurtus, R. (1997). Authoring web-based training. Retrieved November 1, 1999 from the World Wide Web: <http://www.ronkurtus.com/wbt/wbtauthoring.htm>
- Learning on demand: a strategic perspective. Retrieved October 28, 2000 from the World Wide Web: [http://www.cisco.com/warp/public/10/wwtraining/elearning/pdf/lod\\_rpt1\\_cisco.pdf](http://www.cisco.com/warp/public/10/wwtraining/elearning/pdf/lod_rpt1_cisco.pdf)
- Levin, J., Levin, R. & Waddoups, G. (1999). Multiplicity in learning and teaching: a framework for developing innovative online education. Journal of Research on Computing in Education, 32(2), 256–270.
- McIntyre, M. (1997). The web as an effective tool for adult learners. Retrieved November 14, 1999 from the World Wide Web: <http://www.tcm.com/trdev/mcintyre.htm>
- Nielsen, J. (1996). Top ten mistakes in web design. Retrieved from the World Wide Web September 21, 1999: <http://www.useit.com/alertbox/9605.html>
- Neilson, G., Pasternack, B. & Viscio, A. (2000). Up the (e)organization! Retrieved from the World Wide Web June 6, 2000: <http://www.strategy-business.com/strategy/00106/page2.html>
- Pennell, R. (1996). Managing online learning. Retrieved November 14, 1999 from the World Wide Web: <http://elmo.scu.edu.au/sponsored/ausWeb/ausWeb96/educn/pennell/paper.html>
- Polyson, S., Saltzberg, S. & Godwin-Jones, R. (1996). A practical guide to teaching with the world wide web. Syllabus, 10(2), 12–16.
- Reinhardt, A. (1995). New ways to learn. Byte Magazine. Retrieved November 14, 1999 from the World Wide Web: <http://www.byte.com/art/9503/9503.htm>
- Rutherford, P. (1996). Annotations: the key to collaborative teaching and learning on the internet. Retrieved November 1, 1999 from the World Wide Web: <http://elmo.scu.edu.au/sponsored/ausWeb/ausWeb96/educn/rutherford/paper.html>
- Ryan, J., Neece, J. & Meyer, V. Learning on demand drives employee education. Sun Journal, 2(3). Retrieved April 27, 2000 from the World Wide Web: <http://www.sun.com/SunJournal/v2n3/IndustryTrends1.html>
- Salopek, J. (1998). Workstation meets playstation. Training and Development, 52(8), 26–35.
- Saltzberg, S. & Polyson, S. (1996). Distributed learning on the world wide web. Retrieved November 14, 1999 from the World Wide Web: <http://www.umuc.edu/iuc/cm96/papers/poly-p.html>
- Sanders, E. (1998). Learning Technologies. Infoline, 9902.
- Schaaf, D. (1999). Bandwidth basics. Training, 36(9), OL23–OL37.
- Schaaf, D. (1997). A pipeline full of promises: distance training is ready to delivery. Training, 34(10), A3–A22.
- Siemens saves \$2,000 per employee per week. Lotus Development Corporation. Retrieved June 21, 2000 from the World Wide Web: <http://www.lotus.com/home.nsf/welcom/learningspace>
- Smarter Sales Force? Retrieved from the World Wide Web October 28, 2000: <http://digitalthink.com/els/client/3com.html>
- Smith, S., Tyler, M. & Benscoter, A. (1999). Internet supported teaching: advice from the trenches. Education at a Distance, 13(1). Retrieved June 6, 2000 from the World Wide Web: [http://www.usdla.org/ED\\_magazine/illuminactive/JAN\\_1999/internet.htm](http://www.usdla.org/ED_magazine/illuminactive/JAN_1999/internet.htm)
- Southern California Edison uses Macromedia pathware to measure and manage employee training. Lotus Development Corporation. Retrieved June 21, 2000 from the World Wide Web: <http://www.lotus.com/products/learningspace/bb59e0ac1f15f5c8852567fa00833876?OpenDocument>
- Staley, C. (1999). Good and Cheap: No Frills WBT. Technical Training, 10(5), 29–33.
- Steelcase to save resources through the use of web-based training. (2000, May 4). Monday Morning Quarterback. Retrieved May 4, 2000 from the World Wide Web: <http://www.mmqb.com/mmqbnew/mmqb.rsc?mmqb=read&story=050004529382710047521252>
- Stenerson, J. (1998). Systems analysis and design for a successful distance education program implementation. Online Journal of Distance Learning Administration, 1(2). Retrieved April 16, 2000 from the World Wide Web: <http://www.westga.edu~distance/Stener12.html>
- Strandberg, J.E. (1999). Instant answers.com. Training, 36(5), 40–44.
- Ward, S. (1998). Secret recipe for CBT. Technical Training, 9(5), 16–22.
- Wells, R. (1999). Back to the (internet) classroom. Training, 36(3), 50–54.
- Wiley, D., South, J., Bassett, J., Nelson, L., Seawright, L., Peterson, T. & Monson, D. (1999). Three common properties of efficient online instructional support systems. Asynchronous Learning Networks Magazine.

3(2). Retrieved April 16, 2000 from the World Wide Web:  
[http://www.aln.org/alnweb/magazine/Vol3\\_issue2/wiley.htm](http://www.aln.org/alnweb/magazine/Vol3_issue2/wiley.htm)

Williams, R. (1998). Challenges to the optimal delivery of a training program via the world wide web.  
Retrieved September 23, 1999 from the World Wide Web: <http://www.trainingplace.com/source/wbtlimit.html>

# Facilitating self-direction in computer conferencing

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## Introduction

Computer conferencing, which entails "conducting a conference between two or more participants at different sites by using computer networks to transmit any combination of text, static pictures, audio and/or motion video" (Palloff & Pratt, 1999, p.189-190) originally started as a supplementary instructional mode in a conventional face-to-face class. Recently however, computer conferencing is sometimes used as a primary mode of instruction and it is even considered an alternative instructional method with high interest. This trend naturally leads to the question of its educational significance.

There are extensive studies about computer conferencing despite short history and most studies explain or enumerate its characteristics and advantages. However, most publications are theoretical discussions without a concrete case. Recently, a few studies describe what typically happens in an online course (e.g., Eastmond, 1995; McDonald, 1998). Thus, this study describes what really happens in an online course to test the educational value of computer conferencing. Especially, this study focuses on self-direction among many advantages of computer conferencing because it is a usual goal of distance education.

## Computer conferencing

Many studies explain the characteristics of computer conferencing (e.g., Feenberg, 1989; Harasim, 1989, 1990; Kaye, 1989; Mason & Kaye, 1989). The major characteristics of computer conferencing include many-to-many communication, place and time independence, text-based communication, and high interactivity. Computer conferencing makes group communication possible that was impossible in traditional distance education modes. Computer conferencing synthesizes advantages of face-to-face and distance education in that all participants interact with each other and this interaction is time and place independent. In addition, instructors manage learning programs and courses that are adaptive and responsive to the needs of individual learners, by ongoing communication. Consequently, computer conferencing is a paradox in distance education by eliminating psychological separation between learner and instructor through interaction (Saba, 1988).

## Interaction

Distance education can be differently defined according to its major focus. Most distance educators, however, agree that distance education assumes a physical separation between instructor and learner (e.g., Holmberg, 1995; Keegan, 1996). As a result, learners engage in learning, while considering convenient times and places instead of scheduled ones. Thus, learners have independence in time and place. Traditional distance education modes, however, are based on one-way communication in which the teacher controls learning. As a result, learners become more passive in the learning process than in a face-to-face class considering that they can't share their opinions. At the same time, learners experience isolation because of psychological distance resulting from lack of dialogue between learner and instructor or among learners. Consequently, learners do not have independence in controlling and directing their learning process. Especially, considering that learning is a transactional process, which entails exchanging ideas, thoughts, and feelings among people (Palloff & Pratt, 1999), the absence of interaction has been a great weakness, even though early distance education served the solitary learner.

Therefore, distance educators have searched for new educational methods to increase dialogue among participants for effective learning. The history of American distance education supports the importance of interaction in distance education. That is, continuous efforts providing learners with independence in their learning led to interest in interaction among participants during the learning process. Thus, the concept of interaction and its role in distance education have been important topics in distance education research (Moore, 1995).

Why is interaction important in distance education? Interaction in distance education is closely related to individualization in learning. That is, when learners actively interact with instructors or peers, they can address their consistently changing needs. This can lead to suitable learning for each person. This provides learners with independence in the learning process as well. Therefore, interaction is very important in distance education and it explains why many people undoubtedly welcome computer conferencing characterized by high interaction.

## **Self-direction**

For a long time, adult educators have emphasized the learner's autonomy or independence in self-directed learning. It leads to the understanding of self-directed learning in isolation excluding external assistance or interaction. The self-directed learner, however, is not, in Moore's word, "an intellectual Robinson Crusoe, castaway and shut off in self-sufficiency" (1973, p.669, cited in Brookfield, 1986). In this context, many adult educators argue the importance of interaction related to self-direction. Brookfield (1985) states the importance of external sources of assistance regarding self-direction. Garrison (1987) supports the idea that self-direction is highly dependent upon interaction and collaboration between a learner and facilitator. Candy (1991) suggests a new view defining self-direction as a product of interaction between the person and the environments. With the criticism of previous studies focusing on external control in the learning process, recently the definitions and conceptualizations have moved away from equating self-directed learning with sociologically independent learning to an interactive concept.

## **Garrison's model of self-directed learning**

This study followed current research trend focused on multidimensional and interactive aspect of self-direction. In this context, Garrison's comprehensive model (1997) and his concept of control construct (1993) contributed to developing the conceptual framework. According to Garrison, self-directed learning is comprised of self-management, self-monitoring, and motivation and each dimension is very closely connected. Self-management means "decision of learning objectives and activities, and the management of learning resources and support" (p.22). It entails the learner's external control over the learning process. However, Garrison explains the concept of self-management based on collaborative relationships between teacher and learner instead of independence. Thus, self-management does not mean simply learner's external control. That is, self-management (control) consists of three variables, proficiency, resources, and interdependence (Garrison, 1993). Proficiency refers to "the abilities and skills of the teacher and student related to construction of knowledge". Resources refer to "diverse support from teacher and assistance from learner in educational contexts". Interdependence means "teacher responsibilities (institutional or subject norms) as well as learner choice (freedom)" (p.31-33). That is, the learner has independence in transactions with the teacher. Consequently, the balance of each variable influences the extent of control. Control is dynamic by existing in the circle of communication between teacher, learner, and curriculum as well.

Self-monitoring means the internal aspect of self-direction by referring to construction of meaning. It assumes that the learner has responsibility to construct knowledge. This is related to the extent of the learner's cognitive ability and thus it leads to differences in the degree of self-direction. Self-monitoring is a metacognitive process because it needs critical reflection as well. Self-monitoring includes collaborative confirmation. That is, constructed knowledge based on the learner's cognitive ability is confirmed by others in the learning process. Thus, self-monitoring depends on shared control based on transactions between learner and teacher.

Motivation refers to "perception and anticipation related to learning goals at the beginning of learning and mediates between control and responsibility during the learning process" (p.28). Motivation includes entering and task motivation. Entering motivation is related to the decision to participate at the beginning. Task motivation is related to the will to continue the task during the process.

## **Research objectives**

This study explored the extent to which computer conferencing contributes to facilitating self-direction by describing concrete activities. This study focused on interaction among participants related to self-direction because it is very characteristic of computer conferencing. At the same time, it is necessary to study self-direction in group learning rather than individual study.

This study had the following objectives. First, this study explored the possibility that computer conferencing can contribute to facilitating self-direction by describing interaction patterns in an online course. Second, this study sought evidence that learners are self-directed in an online course by describing concrete self-directed activities that occurred in computer conferencing. Third, this study showed the extent of self-direction students have in this course. Finally, this study focused on interaction to explain how learners are self-directed in an online course.

## **Conceptual framework**

This study adapted Garrison's model (1997) considering the characteristics of data and research questions to develop conceptual framework. Consequently, in this study self-direction consists of three dimensions (control, critical reflection, responsibility) and interaction influences self-direction. Self-direction means both overall decision and management related to learning and knowledge construction. Control means the opportunity and the ability related to making decisions in the learning process, capability to manage resources, and cognitive ability to construct knowledge. It consists of interdependence, proficiency, and resources. Critical reflection means the process of constructing personal meaning. Responsibility means learner's active attitude to learn.

### **Case description**

A graduate level course taught adult education via computer conferencing in the Spring of 1998 at a midwestern university was chosen as the case for this study. This course consisted of twenty-one students. Among them were, fifteen females and six males, fifteen majored in adult education and six other majored, seven experienced people of FirstClass®, used as computer conferencing software in this course, fourteen nonexperienced. One female instructor taught this course. Students had one face-to-face meeting at the beginning of course to receive information related to course and to practice FirstClass®. After the initial face-to-face meeting, all discussions depended almost entirely on asynchronous communication. The instructor separated students into four groups considering previous FirstClass® experience, gender, distance to campus, department, and similar name. The instructor posted an overview including readings, brief summary of content, questions and activities for each Week folder. Each group decided on a weekly moderator who read weekly messages posted until Thursday midnight and summarized the discussion. The moderator posted a summary for each week in a Week folder so all four groups has a chance to read the summaries of all the groups' discussion of the past week. Students proceeded group project as well as individual learning activity according to group member's interest.

### **Methodology**

This study analyzed the content of transcripts of participants to explore research questions. In this study, weeks 3, 8, and 13 were selected based on time period, the number of messages, the progress of group projects, and the topic of the week. The total number of messages during weeks 3, 8, 13 was 1,333. It was necessary to code total messages for data analysis. In this study, speech segment created by Henri and Rigault (1996) was used as a single unit for data analysis. After the coding work was finished, inter-rater reliabilities were assessed to decide whether several raters had a high degree of consistency. Cohen's *k* reliabilities for interaction type, function, and self-direction were .95, .90, and .89, respectively.

### **Results and discussion**

#### **Objective #1: Interaction patterns**

The degree of students' participation shows whether this online course is learner-centered or teacher-centered. During weeks 3, 8, and 13, participants posted 1,333 messages. Students posted 1,159 and instructor posted 174 messages. In addition, 21 students generated 1,159 messages during 3 weeks, averaging approximately 19 messages/person/week. Related to interaction type, students provided 94% of initiation. This result was in accord with the previous studies (Eastmond, 1995; Garrison, 1987; Mason, 1988; Seaton, 1993), insisting that an online course should be learner-centered.

#### **Objective #2: Self-Directed activities**

This study categorized self-directed activities which occurred in this online course based on three dimensions of self-direction: control, critical reflection, and responsibility. Selective response, autonomous decision, providing norms, and negotiation were classified as activities of interdependence, one component of control. Interpretation, definition, judgment, and challenging or questioning were classified as activities of proficiency, one component of control. Providing help, sharing information, providing social support, and confirmation were classified as activities regarding resources, one component of control. Revision, correction, finding misconceptions, meeting new perspectives, self-reflection, connecting with previous knowledge, experience, current situation, and knowledge construction were classified as activities of critical reflection. Asking for help, information, clarification, confirmation, and notification of nonparticipation were classified as activities of responsibility.

Self-directed activities classified in this study confirmed the current conclusion that self-direction is multidimensional and is based on interaction. That is, self-directed activities confirmed the conclusion that learners had self-direction through ongoing interaction. After all, students had self-direction in learning in the process of establishing shared agreement, collective knowledge, and shared control. Self-directed activities also reflected a characteristic of computer conferencing. That is, asynchronous communication and text-based communication influenced self-directed activities. For example, students interacted with each other through written messages because computer conferencing is based on text-based communication. Thus, selective response was a strategy for controlling learning content. At the same time, this was a very important tool related to control considering that this course was response-centered. In addition, the self-directed activities that were found reflected the characteristics of group learning based on interdependence and interaction. Thus, these activities had limited generalization to face-to-face courses and individual learning. As an extension of this study, the comparisons between face-to-face and online course and between individual and group learning can contribute to explaining how students are self-directed in virtual group learning.

### **Objective #3: Extent of self-direction**

There were 1,852 speech segments related to self-direction which was 70% of the total speech segments. This means that this course had a relatively high degree of self-direction. Within the three components of self-direction, the number of speech segments classified as control was 1,442, critical reflection was 214, and responsibility was 196. Thus, students' self-direction in this online course appeared to be mainly related to control. The number of speech segments which were classified as interdependence was 143, proficiency was 506, and resources was 793 among the three components of control. This showed that students participated in knowledge construction during the course and they received diverse resources from instructor and peers. The high percentage classified as resources implies that interaction among participants contributed to developing self-direction.

### **Objective #4: Mechanism of facilitating self-direction**

High percentage of resources related to self-direction supports the importance of interaction. Previous studies assumed interaction influences self-direction without evidence. The researcher paid attention to message threads made by participants to examine the relationships between self-direction and interaction. Students sometimes opposed or questioned previously taken for granted assumptions and this engendered other's perspective transformation. Students experienced critical reflection through these processes. Students constructed knowledge and the instructor or peers confirmed it. Thus, interaction connected control with critical reflection. Interaction influenced the relationship between responsibility and control as well. Students asked for help when they experienced technical problems or needed more information and saw this as their responsibility. An instructor or peers provided students with diverse resources. Interaction connected responsibility with critical reflection. Students sometimes did not have a clear understanding because of an ambiguous use of a word. Students asked for more clarification to the author of a problematic message. The author automatically had an opportunity to think again about his or her own message and revise it. This helped critical reflection. After all, three components of self-direction: control, critical reflection, and responsibility are connected each other through learner-learner interaction and learner-instructor interaction.

The mechanism students can be self-directed through interaction in an online course leads to the conclusion that an instructor and peers play important roles related to facilitating self-direction. An instructor and peers influenced student's decision process. Instructor participated in this course one of participants and she collaboratively managed course with students. Related to collaborative course management, the degree of a structure of course is very important because it influences the latitude for student's choice. This course was managed according to a syllabus made by the instructor before course began and weekly overviews during the course. However, even though the instructor decided the overall structure, it could be changed according to students' response. Actually, students sometimes challenged to a rule or decision made by instructor. This resulted in a change of the teacher's structure based on shared agreement. The course structure was maintained not only by interaction between instructor and students but also by negotiation among students. Students sometimes solved problems themselves based on collaborative decisions. The instructor provided students with minimal guidelines and facilitated their learning as not a lecturer but as a facilitator in democratic environment. Thus, students frequently negotiated with the instructor and peers for effective course management and have shared control as a result.

Students built collective knowledge through interaction. An instructor and peers made learner challenge previous or current knowledge and helped to build new knowledge. The role of instructor and peers did not end only

with challenging. The instructor and peers confirmed constructed knowledge. This helped the learner to make his or her knowledge meaningful under this process. In addition, the instructor and peers provided learner with cognitive help related to knowledge construction. When students needed supplementary explanations, they rephrased ambiguous terms and provided suitable examples. Both instructor and peers contributed to building learning community in virtual learning environment.

All participants shared diverse resources in a flexible time schedule. Resources that participants shared were not related to only content and technical aspects. Students shared personal experience. Social support from the instructor and peers helped learner to overcome psychological anxiety and isolation related to using computer conferencing. Consequently, students share same feeling and experience through interaction and feel their learning community.

### **Implications for practice**

This study confirmed that students are self-directed in an online course, as indicated by concrete self-directed activities and their extent. Furthermore, this study explained how students are self-directed in an online course by focusing on instructor and peer's roles. Major findings have several implications for practitioners.

First, this study showed that a low level of structure is related to self-direction. The instructor did not force students to follow fixed procedures but modified the structure to be responsive to learners' needs. Students had room for expressing their needs and making decisions in this environment and self-direction was a result. Thus, it is desirable for students to have an opportunity to choose or decide related to their learning. Instructors should modify traditional authoritative roles and interact with participants in order to create such an environment.

Second, students' self-direction appeared most in the control dimension. Students were self-directed regarding proficiency and resources. This supports the important role of interaction in facilitating self-direction. That is, students collaboratively construct knowledge and frequent feedback from instructor and peers helps students to achieve content and technical mastery. Therefore, instructors and course designers should pay attention to how to provide students with frequent feedback.

Finally, this study confirmed that the learning environment is very important in developing self-direction. Students experienced psychological anxiety related to a new learning environment and missed features of a traditional face-to-face course. However, students found that they studied not alone but together through frequent interaction. Social support from instructor and peers and sharing personal experience made students feel comfortable in the new environment. Thus, instructors should make an effort to develop a comfortable learning environment to facilitating self-direction, for example through informal discussion. A comfortable learning environment will help encourage lurkers to become participants.

### **References**

- Brookfield, S. (1985). Self-directed learning: A critical review of research. In S. Brookfield (Ed.), Self-directed learning: From theory to practice (pp.5-16). San Francisco: Jossey-Bass.
- Brookfield, S. (1986). Understanding and facilitating adult learning. San Francisco: Jossey-Bass.
- Candy, P. C. (1991). Self-direction for lifelong-learning: A comprehensive guide to theory and practice. San Francisco: Jossey-Bass.
- Eastmond, D. V. (1995). Alone but together: Adult distance study through computer conferencing. Cresskill, NJ: Hampton Press, Inc.
- Feenberg, A. (1989). The written world. In R. Mason & A. Kaye (Eds.), Mindweave: Communication, computers and distance education (pp.22-39). Elmsford, NY: Pergamon Press.
- Garrison, D. R. (1987). Self-directed and distance learning: Facilitating self-directed learning beyond the institutional setting. International Journal of Lifelong Education, 6(4), 309-318.
- Garrison, D. R. (1993). An analysis of the control construct in self-directed learning. In H. Long and Associates (Eds.), Emerging perspectives of self-directed learning (pp.27-44). Norman, OK: Research Center for Continuing Professional and Higher Education of the University of Oklahoma.
- Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. Adult Education Quarterly, 48(1), 18-33.
- Harasim, L. M. (1989). On-line education: A new domain. In R. Mason & A. Kaye (Eds.), Mindweave: Communication, computers and distance education (pp.50-62). Elmsford, NY: Pergamon Press.
- Harasim, L. M. (1990). Online education: An environment for collaboration and intellectual amplification. In L. M. Harasim (Ed.), Online education: Perspectives on a new environment (pp.39-64). New York: Praeger.



- Henri, F., & Rigault, C. R. (1996). Collaborative distance learning and computer conferencing. In T. T. Liao (Ed.), Advanced educational technology: Research issues and future potential. Berlin: Springer-Verlag.
- Holmberg, B. (1995). Theory and practice of distance education (2nd Ed.). New York: Routledge.
- Kaye, A. (1989). Computer-mediated communication and distance education. In R. Mason & A. Kaye (Eds.), Mindweave: Communication, computers and distance education (pp.3-21). Elmsford, NY: Pergamon Press.
- Keegan, D. (1996). Foundations of distance education (3rd Ed.). New York: Routledge.
- Mason, R. (1988). Computer conferencing: A contribution to self-directed learning. British Journal of Educational Technology, 19(1), 28-41.
- Mason, R., & Kaye, A. (Eds.). (1989). Mindweave: Communication, computers, and distance education. Elmsford, NY: Pergamon Press.
- McDonald, J. (1998). Interpersonal aspects of group dynamics and development in computer conferencing. Unpublished doctoral dissertation. University of Wisconsin, Madison.
- Moore, M. G. (1995). The 1995 distance education research symposium: A research agenda. The American Journal of Distance Education, 9(2), 1-6.
- Palloff, R. M. , & Pratt, K. (1999). Building learning communities in cyberspace. San Francisco: Jossey-Bass.
- Saba, F. (1988). Integrated telecommunications systems and instructional transaction. The American Journal of Distance Education, 2(3), 17-24Mezirow, 1985
- Seaton, W. J. (1993). Computer-mediated communication and student self-directed learning. Open Learning, June, 49-54.

# An Analysis of Faculty Concerns Regarding Distance Education at Canton College

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## PART A: INTRODUCTION

Nanotechnology, the new frontier of microscopic technology, is shaking up the scientific world with the same “promise and fear” that the atomic theory first shook the world during the 1950’s (*USA Today*, 24 October 2000). The building of mechanical and information machines on a nanometer scale (one-billionth of a meter) has attracted both its supporters and detractors. Advocates point to the promise of one-day sending cancer-detecting microscopic machines into the human body to deliver cancer-fighting drugs. Opponents, on the other hand, warn that terrorists may someday use the technology to create nanosize mechanical germs for release in terrorist’s attacks. Should the scientific community embrace or reject this new technology? What stirs its debate? Is it misunderstanding or legitimate concerns regarding its use or abuse?

New technology, whether it is new technology in the scientific field or new technology in the educational field, spurs debate. In a recent article entitled “College Online: Rethinking How to Learn,” published in the *Watertown Times*, 10 September 2000, distance learning is viewed as a revolutionary force that “looms large on the education landscape.” As established universities race ahead with online programs, faculty members continually debate its virtues and uses. To many educators distance education is an innovative and creative instructional medium. For others, it is the commercialism of education, an educational format plagued by pedagogical uncertainties. Many college campuses across the country are currently engaged in its controversy, and the State University of Canton College is no exception. With its unique blend of liberal arts and technology education, Canton College includes faculty that both support and deny the merits of distance education. No where is this more evident than at faculty meetings where heated debates often erupt between a skeptical liberal arts faction and a so-called “willing” technology and science faction. Such divergent educational viewpoints in one institution, I believe, provide a rich environment in order to research faculty concerns related to distance education.

### Overview of distance education

“Fernunterricht” or “Tele-enseignement” are both European terms for one of the fastest growing and most controversial segments of higher education, distance education. While the terms distance education and distance learning are often used interchangeably, each word has a distinct meaning. Distance education describes the organizational framework and process of providing education at a distance. In this framework, teachers and students are separated by physical distance and technology is used to bridge the instructional delivery (Moore 1989). Distance learning, on the other hand, identifies the intended instructional outcomes and depicts the learning that takes place at a distance. Every effort will be made in this paper to adhere to these specific definitions.

### Historical perspective

Most people assume that distance education is a relatively new phenomenon. However, the growth in the area of distance education is best characterized as evolutionary rather than revolutionary (Willis 1994). Learning at a distance has been going on for years; it is the mode of delivery that has changed. Today, audio, video and computer technologies are more common methods of delivery than the historical correspondence courses of years ago.

Traditionally, distance education students have been adults, studying part-time and geographically distanced from the enrolled campus. Access to continuing and higher education has typically been the primary motivating factor in students enrolling in distance education courses. Recent evidence suggests that this demographic trend is changing. Younger, local students with full-time course loads that combine distance education courses with on-campus courses now comprise new student populations (Wallace 1996). While students of the past sought access to continuing and higher education; students of today are attracted to distance education because of the ability gain control over the time, place and pace of their learning. Consider the following article entitled, “SUNY Online Classes Giving More People Access to Higher Ed,” appearing in the *Watertown Times*, 20 October 2000:

Ms. Walker is a full-time student at Jefferson Community College. Four days a week she commutes to take four night classes. There were not enough hours in her schedule to take another class, so he decided to take one of her classes online. “This course is working wonderful for me as a mother because I can do it at home. I wouldn’t be able to take a fifth class if it wasn’t online.”

## **Delivery Technologies**

Distance education involves two main delivery methods: synchronous (interactive video) and asynchronous (online or web-based). Synchronous learning is the simultaneous participation of student and instructor. Instructional delivery is at the same time, but at different locations. For example, various campuses in the State University of New York (SUNY) are linked to one another via a telecommunications line. This telecommunication line transmits live video. Thus, a SUNY Canton site may be transmitting a “live” course via television to another SUNY campus, allowing live group discussion between sites. In order to accommodate synchronous delivery, special distance learning classrooms must be constructed. These classrooms are equipped with television monitors, ceiling microphones, sound proof walls, as well as computer and other technological equipment necessary to conduct interactive classrooms. Such classrooms can be expensive. They require a significant initial capital investment, and funding for on-going equipment maintenance and support.

Asynchronous instruction, on the other hand, does not require that student and instructor be located in the same location at the same time. Instructional delivery is at different times and different locations. Examples of asynchronous delivery include email, listservs, and web-based or online instruction. Asynchronous instruction can occur anytime, anyplace, as long as the student has a computer and access to the course through a registration process. Students are able to choose their own instructional time frame, and studying lectures and participating in their class according to their own schedule. The primary advantage of asynchronous learning is flexibility; students choose the location and the time for learning. However, there are disadvantages to online instruction. These include considerable email-based written exchange and online development training needs of the faculty. Both forms of instructional delivery will be included under the general term distance education for purposes here.

## **Trends in distance education**

According to the U.S. Department of Education, National Center for Education Statistics (1999): Nearly 80% of public, four-year institutions and over 60% of public, two-year institutions offered distance education courses in the 1997-1998 academic year. Overall, U.S. higher education institutions reported 1, 661,100 students are enrolled in distance education courses. The most popular delivery technologies used were asynchronous Internet instruction (58%), two-way interactive video (54%), and one-way pre recorded video (47%). This year the State University of New York (SUNY) system itself enrolled more than 20,000 students in distance learning courses, 7,000 more than last year. Five years ago only 119 students were taking distance learning courses. It is estimated that in the next two years 85 percent of American colleges will be offering online courses to over two million students (Moore 2000).

## **History of distance education at Canton College**

Canton College has been using both asynchronous and synchronous methods of distance learning since 1997. The college uses a 2-way audio/visual conferencing system, interactive television, to send and receive classes to and from other state colleges. More than 2,000 students have participated in course offerings that have included Companion Animal Behavior, Criminal Law, Business Communications and Wine Tasting. Recently, the college has begun an ambitious project with China utilizing interactive video to broadcast courses in English Conversation to a class of twenty Beijing high school students. Canton also participates in the SUNY Learning Network, an umbrella organization offering online courses at forty-five SUNY institutions (see Appendix A).

## **PART B: PURPOSE AND OUTLINE OF PAPER**

It is my intent to study distance education at the State University of New York at Canton College, juxtaposing viewpoints from a humanities and liberal arts perspective with those of a science, medical and technical perspective. It is hoped that such an analysis will provide an interdisciplinary context for understanding faculty concerns and a framework for applying current educational research to specific faculty issues.

### **Why this thesis?**

I developed this thesis as a result of witnessing the many skirmishes and debates among fellow faculty members over the use and value of distance education. I listened as faculty expressed their concerns over distance education and deliberated its merits. While many of my colleagues expressed a substantial amount of opinion, I

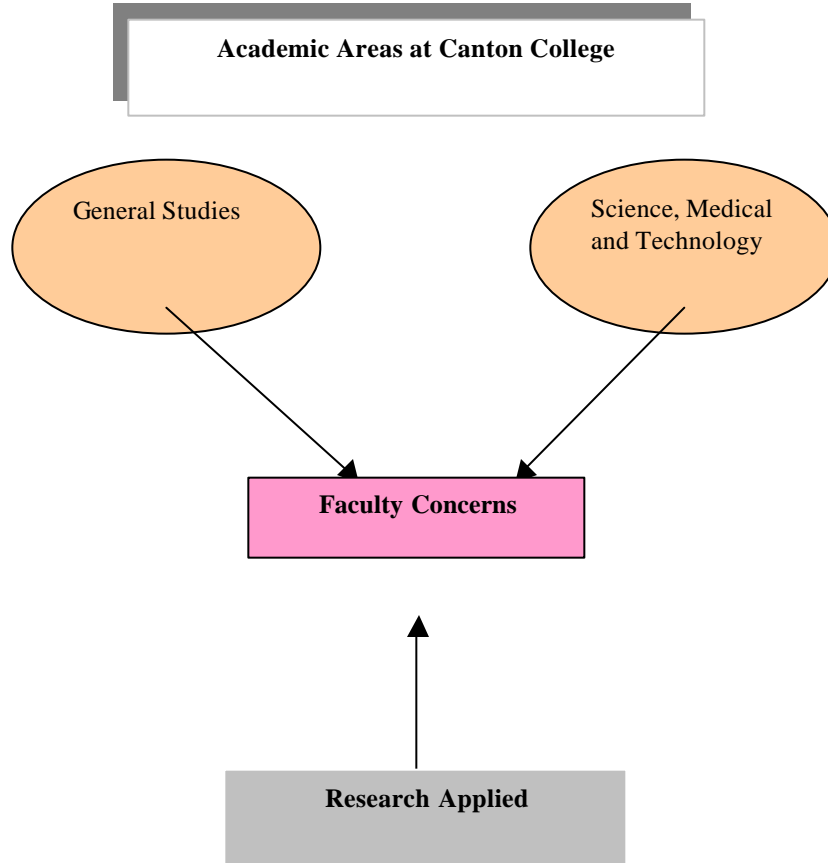
heard little research applied to such concerns. If faculty members believe that student learning is compromised by distance, I wanted to know whether or not educational research supports this claim. I was also curious about the pattern of opinion I observed at the college. It seemed that those faculty representing the liberal arts, writing and humanities curricula were quite vocal against distance education, while those members of the science, medical and technical aspect of the campus appeared either nonaligned or willing to explore the use of distance education in their courses. I wondered if the various schools of education at Canton College shared any common ground of concerns, or did any one faction harbor specific concerns while others did not. More importantly, could I explore the merit of these issues through the use of educational research? The answers to these questions form the basis of my paper.

### **Biases Acknowledged**

I think it important to acknowledge my personal background and biases regarding distance education. I have been instructing one course via three different instructional modalities, two of which are taught in a distance learning format. In the fall semester, I teach the course on campus, while in the spring and I teach the course via interactive video and the Internet. As a result of this experience, I am keenly aware of issues surrounding distance education, both political as well as pedagogical, and understand the concerns that many faculty members have on campus regarding its use in higher education. However, I feel such experience has only made me more willing to explore research into this area of education. I believe that my experience with distance education will not inhibit the execution of my thesis, rather, I hope it will provide a knowledgeable context to record faculty concerns and a dispassionate vehicle for applying educational research to these concerns.

### **How this project was conducted**

The intent of this project was not to engage in rigorous scientific study, but rather, to explore general perceptions regarding distance education and to provide a cross-sectional representation of faculty concerns at Canton College. I divided the academic schools at Canton College into two fields of interest: general studies (sociology, psychology and English) and science, health and technology. Three representatives from each respective school were then asked to participate in personal interviews. Faculty members with varying degrees and experience in distance education were selected. An honest effort was made to objectively choose faculty without a reference to their beliefs; however, I must acknowledge that I did choose those faculty I knew to be abundant in their opinions so as to obtain as much data as possible. Each faculty member during the interview was asked to discuss particular issues or concerns that they had related to distance education and to prioritize such issues. Educational research, including published formal studies and journal reports, was then applied to specific faculty concerns regarding distance education.



## PART C: FACULTY OPINIONS ON DISTANCE EDUCATION

### Overview of Faculty Outlook

Currently, one in 10 higher education National Education Association (NEA) members teaches a distance education course (NEA, 2000, 4). The Association's June 2000 report, "A Survey of Traditional and Distance Learning Higher Education Members", provides statistical information regarding faculty outlook towards distance education. Among the findings:

- □ 51% of traditional faculty hold positive feelings toward distance education courses, compared to 22% who hold negative feelings. A significant proportion, (28%), of traditional faculty remain undecided.
- □ Among distance learning faculty, 72% hold positive feelings compared to only 14 % who hold negative feelings.

United University Professions (UUP), a union comprising 24,000 academic and professional faculty from 29 campuses, conducted a similar poll. Members were asked about the issue of distance learning within the State University of New York (SUNY) system. Published results from a poll of 500 UUP members indicated that members were overwhelmingly receptive to the use of distance learning but expressed a strong skepticism about its quality, effectiveness and impact on their profession (*Scheurman 2000,11*):

- □ 72 percent of respondents believe distance learning will mean more work for the same pay.
- □ 73 percent of respondents worry about their intellectual property rights.

- 68 percent of respondents do not believe that distance learning courses provide the same quality as traditional courses.

#### Faculty Outlook at Canton College

The debate between the new and the old, technology and traditional, has been going on since the days of Plato and Socrates. Socrates, versed in the traditional art of oral education, refuted the written expression, the new educational format of his student, Plato. Such an analogy parallels the resistance of traditional pedagogy to new educational delivery, distance education (Horn 2000).

Ultimately, the success of any distance education program rests with the faculty. In general, Canton College faculty expressed concerns ranging from pedagogical and student achievement issues, to those of assessment, compensation and workload. Faculty seemed most concerned with issues of quality learning and less concerned with issues of copyright and compensation. Although issues of workload, compensation etc. were important to Canton faculty, they seemed less important than the issues of quality instruction and student learning. Interestingly, this observation somewhat parallels the 1999 NEA findings in which polled faculty reported that they evaluated distance education primarily on quality of education and secondarily on more traditional union considerations (NEA, 2000, 35).

#### Interview Results

Interview results reflecting individual faculty concerns regarding distance education and comments related to those concerns, can be found in Appendix B.

### **PART D: RESEARCH APPLIED TO FACULTY CONCERNS**

#### **Concern: Student Achievement**

Of primary concern to the faculty at Canton College is the question of student learning. Do distant students learn as much as students receiving traditional face-to-face instruction? Faculty members at Canton College were passionate in their belief that student achievement is significantly lower in a distance education than it is in traditional instruction. Many faculty members argued that students do not learn as much, as well, or as effectively in a distance learning format as they do in a traditional learning format.

However, hundreds of general media comparison studies conducted over the last forty years have demonstrated no significant difference in achievement levels between distant and traditional learners (Cyrs 1997,4). Most of this research has generally been in the area of instructional television. Studies by Crow (1977) “found that there was no significant difference in student achievement regardless of the proximity of the instructor.” Dubin and Travaggia’s (1968) longitudinal study demonstrated “clearly and unequivocally that there is no measurable difference among truly distinctive methods of college instruction when evaluated by student performance.” Whittington (1989), in his review of research literature on distance education concluded that “findings of equivalent student achievement hold even when rigorous methodological research standards are applied.” According to DeLoughry (1998), students learn as much and as well in computer-mediated instruction as they do in traditional educational settings. DeLoughry cites a study conducted by researchers at the New Jersey Institute of Technology to support his claim:

Researchers tested the effectiveness of online instruction by studying five courses in which a total of 98 students were enrolled for classroom-based instruction and 80 others were instructed online. A comparison of the average test and course grades for the two groups in each course turned up no statistically significant differences between the experimental and control groups.

Research has also demonstrated in general that students learn at a distance as well and as effectively as students in traditional face-to-face classrooms (Cyrs 1997,4). The following excerpt from Clark (1983) summarizes the influences of media on student learning:

Media comparison studies clearly suggest that media do not influence learning under any conditions. The best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition. Basically, the choice of vehicle might influence the cost or extent of distributing instruction, but only the content of the vehicle can influence achievement (Clark

While comparison studies may document education outcomes, they omit several key concepts regarding student learning. First, comparison studies do little to address learner experience, i.e., student satisfaction levels and student attitudes. In essence, they ignore the role of social presence in student learning. Recent educational research on distance learning has recognized this deficiency and is now shifting the focus from comparative studies to theory-based studies. Theory-based studies explore the social aspects of student learning. Fahab (2000) outlines the following research findings:

- Fulford and Zhang (1993) evaluated learner perception of interaction in instruction. Their research findings concluded that overall interaction dynamics may have a stronger impact on learners' satisfaction than strictly personal participation.
- McDonald and Gibson (1998) explored interpersonal interaction and group development in an asynchronous distance education environment. Their studies concluded that students are capable of resolving interpersonal issues and form organized, cohesive working groups.
- Gunawardena (1995, p. 164) studied the social presence theory for community building in computer mediated conferencing. She concluded "in spite of the low social context cues of the medium, student perceptions of the social and human qualities of the medium depends on the social presence created by the instructors and the online community."
- Tsui and Ki (1996) studied school factors affecting computer mediated instruction. Their study revealed that communication among students was bilateral, as students often hesitated to enter a dialog started by two other students.

Recent studies by Kanuka and Anderson (1998) also address the social process of learning in a distance education environment. After studying the interaction among participants in a distance education forum, both researchers determined that a "significant time was engaged in social interchange followed occasionally by social discord. Social discord served as a catalyst to the knowledge construction process."

Secondly, although learning outcomes and student achievement levels are documented in media comparison studies, "quality outcomes" are not. What are quality outcomes? Do they simply imply satisfied learners or are they outcomes that demonstrate that students have achieved cognitive skills not previously possessed prior to their distance learning experience? Comparison studies would do better to qualify outcomes in their analysis.

Thirdly, although these comparison studies have addressed distance education as a whole, they have yet to explore the intricacies and particular features of each of the various distance learning modalities. Little attention has been given to specific media features and how such features contribute to learner outcomes. For example, how does a particular computer-mediated medium that uses audiographics contribute to student interaction? Michael G. Moore, in his editorial on the 1995 Distance Education Research Symposium, brings this issue to focus:

We must begin to look at the distinguishing characteristics of these different settings. A further step is to ask how these contexts affect the learners, and their learning, the learning experience, process and outcomes (*Moore 1995*).

It would be a judicious for comparison studies to explore learner characteristics as well. As distance education moves from a marginal to integral role in higher education, learner characteristics and their role in the process of learning will become increasingly important

(Powell, Conway, Ross, 1990). Traditionally, successful distance learning students have been identified as older, working students possessing time management skills, high self-motivation, a positive attitude, and risk taking personalities. Demographic changes, however, will eventually alter learner characteristics. Characteristics of success that have previously defined successful distance learning students may not be characteristic of a new distance education population.

### **Concern: Distance Education as Big Business**

Several faculty members at Canton College expressed their concern that distance education has increasingly become a consumer commodity, rather than a vehicle of education. They believe profit is the primary motivating factor in the implementation of distance education in colleges and universities across the country. A recent editorial in *AFT ON CAMPUS*, November 2000 supports this conclusion: "Wall Street is waging huge sums on the convergence of education and the Internet. There's e-commerce, now there's e-learning" (Gladieux 2000,10). Wall Street's interest in online higher education has spurred college administrators interest in online education. Green (2000) cites a recent article in *Forbes*: "[Business-to-consumers] is yesterday's story. Education-to-business and education-to-consumers is tomorrow's."

Traditionally private, for-profit companies occupied the technical training or blue-collar aspect of the distance education market. This is changing. For-profit education companies such as HungryMinds, SmartPlanet, eHigherEducation, SmartForce and eLearning are now competing with colleges and universities for the market share of distance education programs in continuing higher education. SmartForce reported sales worth of \$189 million in 1999; eLearning generated revenues of nearly \$100 billion (AFT ON CAMPUS 2000).

Increasingly, these same for-profit institutions are also competing with colleges that offer credit courses and degrees. The response of public institutions to the incursion of these companies has been twofold: colleges are now forming partnerships with such companies, or they entering the for-profit field themselves. (Moore 2000). The University of Colorado, for instance, has formed a partnership with eCollege, the large for-profit education industry (see Appendix C). New York University has created its own for-profit educational company, NYU Online. The University of Phoenix, with a student population of at least 56,000, is the largest for-profit university in the US. Other corporate alliances and educational institutions include California State University and the publishers Simon & Schuster likewise, the University of Washington has entered a partnership with Prentice Hall.

Consider the following Internet headings:

▶ **REPRESENTATIVES OF NEW YORK UNIVERSITY'S ONLINE DEGREE PROGRAM** are talking to agencies about NYU Online's estimated \$10 million budget (*Brandweek Online 2000*).

▶ **COLUMBIA UNIVERSITY ESTABLISHES NEW COMMERCIAL VENTURE IN ONLINE EDUCATIONAL RESOURCES** Commercial business will be used to develop online courses and build strategic alliances with the most competitive Internet related businesses (*Chronicle of Higher Education 2000*).

▶ **'E-LEARNING EXPERIENCE'**  
Universities 21, a network of 18 prominent universities in 10 countries, announced plans Monday to develop online-learning materials with Thomson Learning -- a division of the Thomson Corporation, an international company focusing on electronic delivery of information (*Chronicle of Higher Education 2000*).

▶ **WHAT MAKES A 'DOT-EDU'?**  
Community colleges have stepped up their fight for the right to use World Wide Web addresses ending in ".edu" -- an increasingly coveted distinction as colleges and companies compete for distance-education students online. (*Chronicle of Higher Education 2000*).

going to

based forms of distance education, institutions no longer occupy certain geographic niches or maintain their existing

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spheres of influence (Moore 1999). Consequently, external competition has forced many colleges and universities to enter the global educational market. Institutions are adopting strategies to ensure competitiveness; these strategies include distance education.

Education on demand will dominate the marketplace and those institutions that can adapt to those changes will thrive. Those that do not may find themselves out of business (Olcott 1996).

Just what are the implications of merging distance education with big business?

Michael Moore, in his editorial on distance education and big business, expressed the following concerns:

1. Distance education will contribute to *widening the issue of inequity*. The traditional spirit of distance education was to provide access to those people denied opportunity to conventional education. Access today to the new distance education requires access to the new technology. "Americans living in rural areas are still behind those in urban areas in Internet access." (Moore 2000).
2. Distance education will *align itself to the principles of business*. Investments will be targeted in the rich markets of the health industry, business and information technology. Continuing education needs of the rest of society may not be addressed.
3. *Price wars*, common in the private sector and industry, will infiltrate education. Will institutions that undercut each other's price, undercut quality as well?

Some question whether school itself has been transformed into a lucrative market (Apple). In "Digital Diploma Mills" David Noble condemns distance learning as the "degradation of the quality of education in pursuit of the dollar" and maintains that dollars not pedagogical interest, are behind these partnerships (Scheurman 2000, 11). Noble views distance education as "the biggest threat ever" to institutions and faculty.

Many schools are unaware of the risks of associated with moving online. Schools rush online to increase revenues and for fear of being left behind in the competitive market. Today, 75 percent of two- and four-year colleges offer some form of online, and the number is expected to increase to 90 percent by next year (Green 2000). This represents a dilemma for smaller colleges and universities. Smaller schools offering online courses and degrees will have to compete with the larger, more prestigious schools like Duke and Harvard University for students. Colleges and universities will need to hire sales and marketing teams just to attract students to programs. "Marketing will become more costly as the field grows and name recognition becomes ever-more difficult to establish" (Green 2000). Software development companies can spend up to \$ 1 million developing a single course. As more schools adopt the gold-rush mentality, questions exist who will survive in a crowded market have fallen by the wayside." (Green 2000).

In Joshua Green's essay "The Online Education Bubble" Green cautions college administrators to be wary of rushing online in a capricious and fickle Internet market:

Many schools seem blissfully unaware of the risk associated with moving online. Online education could be the latest in a string of over hyped Internet concepts in which an excess of giddy supply overestimates the demand (Green 2000).

College administrators, like businessmen, view technology as a vehicle for cutting costs and generating revenues. Technology means productivity. David Noble, an outspoken critic of distance education, believes online courses serve as "a potential means of generating revenue for universities while cutting labor costs to the core (*ON CAMPUS* 2000). However the data suggests that many industries experience performance enhancement with technology rather than an increase in productivity or profitability with technology (Fahey 1998). Colleges and universities are not immune to this productivity paradox. According to William Scheurman, president of UUP and American Federation of Teachers (AFT) vice president: "You can't use the technology as an end to save a buck. Once education is driven by savings, savings become the goal and education slips to a subordinate position (Scheurman 2000, 11).

### **Concern: Appropriate Pedagogy**

Canton College faculty expressed considerable concern regarding to pedagogical issues and distance education. Many of the traditional faculty that were interviewed for this paper characterize their teacher role as one of “content provider” and “skilled facilitator” whose primary teaching methodology relies heavily upon personal interaction with students. Faculty members believe that distance education, in either its synchronous or asynchronous form, is impersonal, lacking the impact of direct contact with students. Many view distance learning as a poor substitute for “face-to-face” instruction.

At the heart of this pedagogical debate is the issue of student-to-student, student-to-content and student-to-instructor communication. Interaction is vital to the learning process (Bruffee 1982 & Flanders 1970). It provides a dialogue and a framework for confronting ideas and negotiating meaning. Pedagogy that enhances communication and social presence ultimately promotes effective instruction. Therefore, strategies that encourage student involvement, provide individual feedback, and promote interpersonal relationships do best to foster interaction. Qualities such as voice variation, self-confidence, stage presence and mastery of information are equally as important. While all of these are essential characteristics of an effective and engaging instructor, they become even more critical in a distance environment. Faculty question whether such qualities and methodology can effectively be transferred to an environment in which student and instructor are separated by distance.

It has been argued that it is the essential role of the teacher to guide and monitor students through the learning process. Garrison (1990) maintains that students need interaction with the teacher in order to “question and challenge pre-existing viewpoints and validate the knowledge gained.” Streibel (1998) believes student require an instructor’s help in formulating, understanding and solving problems. If interaction is so critical to the educational process, how is this achieved in distance learning settings?

Much of the educational research surrounding distance education has been devoted to documenting learning outcomes, and less effort applied to understanding the essential nature of an educational learning experience. According to Wong (1987,p.9), the “focus of much institutional effort in distance education has been directed toward the packaging and delivery of knowledge for the independent adult learner...[and] little attention has been paid to the nature of the human-to-human and human-to-machine interactions in the learning process. Institutions emphasize putting courses online rather than the choice of appropriate pedagogy (Winograd 2000). As Eastmond (cite) points out, “process fall short of theory.”

Furthermore, educational research has not evaluated the effectiveness of interactive strategies that are currently being promoted and used by distance learning instructors. Chat rooms, discussion forums for students, are commonly employed as an interactive tool promoting communication among classmates. While chat rooms do provide students with the vehicle to discuss ideas among themselves, they may also lead to the reinforcement of mistakes and misunderstandings of course materials. Interactive strategies would do best if framed by educational research.

Other questions persist regarding appropriate and effective teaching strategies in a distance learning environment. How do instructors achieve elaborate encoding (i.e., the conscription of learning in a meaningful way in their distance courses)? Some educators recommended that frequent, short quizzes with scores and comments displayed assist in elaborate encoding and reinforcement (*Syllabus* 2000). Once again these may be worthwhile teaching strategies, but studies validating these findings are lacking.

### **Concern: Student dropout rate**

Many Canton faculty associate distance education with high attrition and believed that student profiles are the most likely factors influencing course completion. Research, however, indicates multivariate reasons for student drop out. While descriptive analysis points to learner characteristics as a pivotal factor in student attrition (Rekkedal (1993, 19), learner characteristics are just one part of the puzzle. Kennedy and Powell (1976, 61) reported that students may drop out of distance education courses because of academic intimidation and the fear the lack of ability “to learn to debate and communicate in a manner which is acceptable to the academic community” (Cookson 24). Recent research using a micro-sociological approach to analysis suggests a combination of student characteristics and life circumstances preclude students from completing a course:

The individual part-time student has a difficult time in maintaining an equilibrium of pressures within his life, pressures arising from his job, from his domestic situation, from his academic work and also from possible variations in his own personality (Kennedy and Powell 1976 ,61).

Ostman and Wagner (1987, 47) studied of the influences of demographic, social interaction, psychological, and institutional variables on course withdrawal and found that lack of time constituted the most influential single predictor of discontinuance.”

### **Concerns: Workload, compensation**

NEA (2000) findings support faculty concerns of increased workload and inadequate compensation:

- Over half (53%) of distance learning faculty spend more hours per week preparing and delivering their distance learning courses than they do for a comparable traditional course.
- In spite of spending more hours on their distance learning course most (84%) of faculty receive no course reduction. 63% are compensated for their course as if it were part of their normal course load.

Yet, such data does not address the role providing institutions play in the support and design of distance learning courses. Access to instructional designers and other support personnel could greatly reduce time spent delivering instruction. Likewise, time and effort is dependent on the degree of interaction between instructor and student. Courses that encourage interaction require more time investment. Workload can be reflective of institutional support as well as individual instructor strategies.

### **CONCLUSION**

Faculty members at Canton College acknowledged the value of distance education in providing access and time flexibility to non-traditional working students. They were, however, doubtful about the quality of distance education and concerned about the impact distance education may have on their profession. Both academic areas at Canton College expressed similar viewpoints regarding distance education. While members of the science, medical and technology areas of the college were the ones most likely to utilize some form of technology in their instruction, they nonetheless expressed similar concerns regarding distance education as did the humanities and liberal arts curricula. Analysis of faculty concerns at the college did not portray any one faction as vehemently for or against distance education. This was quite the contrary to the dialogue expressed at faculty meetings. Perhaps the context of one-on-one interviews influenced the presentation of opinions.

Many of the concerns that Canton College faculty expressed during their interviews are shared by other institutions of higher education as well. A recent transcript in the

*Chronicle of Higher Education* (2000) detailed a discussion between regarding the impact of distance education (specifically online education) on community colleges. Much of the dialogue echoed the issues Canton College faculty raised during their interviews. Community college faculty expressed concerns over standards for distance education, attrition rates, competition choking or reducing offerings, quality of instruction, workload release time, support, faculty rights and compensation.

Faculty members at the college believed that little educational research has been applied to distance education. This is not true. Much inquiry has been dedicated to quantifying learning outcomes. Invariably, comparative studies of distance education and classroom instruction have proven time and again no significant difference between distance education learning outcomes and those of traditional instruction. However, such research fails to address the complexities of distance education, doing little to explore the theoretical foundations of the field. Recent studies, however, have begun to investigate the social experience of distance education, documenting learner perception, experience and attitude.

Faculty members question the pedagogical soundness of distance education. Many view distance education as an assembly-line approach to education, a medium for delivering more data and less knowledge. They argue that distance education hinders interaction, precluding the exchange of social and verbal cues between instructor and student. Pedagogical approaches that increase interaction and successfully engage students in the process of learning would most likely augment student scholarship. Yet such approaches have yet to be informed by educational research.

The evidence supports faculty concerns that distance education is a vehicle for big business. Partnerships between corporations and major universities are increasingly common. Institutions are forced to compete for students as never before. The effect of such competition will have on smaller schools that have limited resources and

visibility remains unclear. Administrators view distance education as a cost-saving and revenue-generating measure. The following excerpt from Michael Moore (2000) is a sobering reflection on the relationship between distance education and the business model of productivity:

Plans at the University of Georgia Board of Regents call for the entire first two years of the university curriculum to be available over the Internet, and for complete degree programs in all traditional disciplines to be available by 2002. One curriculum will be offered to every student in the state. The board will select faculty members (eight per course) from throughout the state university system to construct each core course. There will be a designated instructor/facilitator for evaluation. Facilitator faculty will have no academic freedom regarding the courses they teach (Moore 2000).

## PERSONAL REFLECTIONS

As I listened to my colleagues discuss distance education I could not help but sense their apprehension over the rapid changes in education. They seemed, however, resigned to the fact that higher education, despite our best protests and ideological concerns, was on a path of change that none of us had expected or anticipated twenty years ago.

Distance education is a reflection of the changes occurring, not only in high education, but in society as well. Technological advancements such as the Internet have shaped businesses and influenced policies, both governmental and educational. While distance education has made it easier for people to access higher education, the technology that drives its delivery is unavailable to many. Ironically, the same technology that seeks to avoid inequity, may be the cause of it.

Distance education also forces us to re-evaluate our roles as faculty, students and institutional members. Many in the educational community are reluctant to embrace its concept. They cite issues such intellectual property, fair compensation, impact on quality of education, increased workloads, adequate compensation for development and implementation of courses and decreased student-learner interaction as mainstays of their resistance. These issues are real, and yet to be resolved.

The lack of sound pedagogy is perhaps the most critical issue for me. Suggestions from experienced distance learning instructors regarding effective methodology and teaching strategies do not bear the weight of sound educational research. I believe there is much to learn about the social learning experience of students in a distance learning environment.

I also believe that colleges and universities ignore the realities of market demand. Distance education is not a substitute for the budget woes or fiscal dilemmas that plague our colleges, nor is it a substitute for the day-to-day interactions that define the brick and mortar experience of traditional education.

## General Studies

**Interview #1**  
**Profile: Sociology professor 12 years**  
**Experience with distance education: little**

Primary Concern	Comments
Loss of student/teacher relationship	Primary role as a teacher is "sage on stage". Teacher-centered pedagogy. Paid to interpret information and giving information is "contingent upon reading my cues from my audience."
Other concerns	Comments
Student characteristics	Traditional students seem to lack self-discipline. How would such a student fit into or succeed in a distance learning environment? A campus setting allows physical presence of the instructor at a set time, not possible in distance learning settings.

Education as big business	See institutions as public service trying to emulate a business model and make faculty entrepreneurs (this affects teaching).
Time investment, compensation and intellectual property rights	Certainly an issue, but not primary

**Interview #2**

*Profile: Psychology professor 17 years*

*Experience with distance education: little; experienced with multimedia*

<b>Primary Concern</b>	<b>Comments</b>
Impersonal process Little interaction outside the classroom Can not extract the social process	Allows image to be the role model Focus not on student-teacher interaction, rather, on “presentation material” Virtual skills –only apply in a virtual world
<b>Other concerns</b>	<b>Comments</b>
Quality of education	Distance education diminishes quality
Emergence of “two tiers of education”	Virtually educated vs. Traditionally
Time investment, compensation and intellectual property rights	Certainly an issue, but not primary

**Interview #3**

*Profile: English professor 20 years*

*Experience with distance education: none*

<b>Primary Concern</b>	<b>Comments</b>
Lack of student interaction	Face-to-face a priority One-on-one interaction- office hours Lectures more effective in delivering instruction
<b>Other concerns</b>	<b>Comments</b>
Lack of training	Would need a lot
Time investment, compensation and intellectual property rights	Certainly an issue, but not primary.

**Science, medical and technology**

**Interview #4**

*Profile: Wireless Communication 12 years*

*Experience with distance education: none, extensive multimedia*

<b>Primary Concern</b>	<b>Comments</b>
Student motivation (learner characteristics)	Students are not motivated in class, less so in an online environment
<b>Other concerns</b>	<b>Comments</b>
Lack of interaction	“Interface tends to alienate” People go to college for interaction- the college experience (You can’t have bear blast over the Internet!)

Time investment, compensation and intellectual property rights	Certainly an issue, but not primary.

**Interview #5**

**Profile: Chemistry Professor 28 years**

**Experience with distance education: none, extensive multimedia**

Primary Concern	Comments
Student achievement	Would be poor for traditional 18-20 year olds.
Other concerns	Comments
Lack of personal interaction, although this is course dependent	Face-to-face interaction provides motivation. Acknowledges that discussion can occur in distance education environment
Support issues	Need adequate communication between instructor and (infrastructure)computing center
Time investment, compensation and intellectual property rights	Certainly an issue, but not primary.

**Interview #6**

**Profile: Biology Professor 4 years**

**Experience with distance education: none, extensive multimedia**

Primary Concern	Comments
Lack of student interaction	Role of the professor is to provide motivation, create interest, explain concepts, provide direction. Would be difficult to transfer this approach to a distance education format
Other concerns	Comments
Student achievement	Believe significantly lowered
Student motivation	"Traditional students can't pay attention"
Distance education is "edu-tainment"	Traditional education emphasizes content; distance education emphasizes delivery
Marketing	"Who wants 100 Introduction to Biology courses?"
Time investment, compensation and intellectual property rights	Certainly an issue, but not primary.

**Additional comments:**

- Lack of educational research frames distance education
- Pedagogical approach would be difficult to transfer to a distance learning environment
- Administration encourages faculty to produce online courses. Appropriate pedagogy not addressed.
- Validity of distance education noted: expanded opportunities for commuters and working non-traditional students

**Literature Cited**

- Beyer, Landon, and Michael W. Apple, eds. 1998. *The Curriculum Problems, Politics, and Possibilities*. Albany: State University of New York Press.
- Bruffee, K.A. 1982. CLTV: Collaborative learning television. *Educational Communications and Teaching Journal* 30:26-40. Quoted in Ritchie, Helen, and Timothy J. Newby, Classroom Lecture/Discussion vs. Live

Televised Instruction: A comparison of Effects on Student Performance, Attitude, and Interaction (American Journal of Distance Education), 36-45.

Clark, R.E. 1983. Reconsidering research on learning form media. *Review of Educational Research*, 53:445-59.

Cookson, P.S., 1989. Research on learners and learning in distance education. *American Journal of Distance Education*, 3:22-34.

Crow, M.L. 1977. *Teaching on television*. Arlington, TX: Faculty Development Resource Center, University of Texas. Quoted in Thomas E. Cyrs, *Teaching at a Distance with the Merging Technologies* (New Mexico: Center for Educational Development, 1977), 4.

Cyrs, Thomas E. 1997. *Teaching at a Distance with the Merging Technologies*. New Mexico: New Mexico State University.

DeLoughry, T.J., "Remote Instruction using computers found effective as classroom session," *Chronicle of Higher Education*, April 1988, A18-21.

Dubin, R. & Tavaggia, T.1968. *The teaching-learning paradox: A comparative analysis of college teaching methods*. Eugene, OR: Oregon University, Center for Advanced Study of Educational Administration. (ERIC, Document and Reproduction Service ED 026 988). Quoted in Barry Willis, *Distance Education Strategies and Tools* (New Jersey: Educational Technology Publications, 1994) 35.

Flanders, N.A. 1970. Analyzing Teaching Behavior. MA: Addison-Wesley Publishing Company. Quoted in Ritchie, Helen, and Timothy J. Newby, Classroom Lecture/Discussion vs. Live Televised Instruction: A Comparison of Effects on Student Performance, Attitude, and Interaction (American Journal of Distance Education), 36-45.

Fulford, C.P., and Zhang, S. 1993. Perception of interaction: The critical predictor in distance education. *American Journal of Distance Education* 7:8-21. Quoted in Saba, Farhad, 2000. Research in Distance Education: A Status Report. *International Review of Research in Open and Distance Learning* 1:3.

Garrison, D.R., 1990. An analysis and evaluation of audio teleconferencing to facilitate education at a distance. *American Journal of Distance Education*, 4:13-24.

Gladieux, Lawrence E. 2000. Global online higher education: new engine for inequality? *ON CAMPUS*, 20:10.

Gunawardena, C.N., and Zittle, F.J. 1997. Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. *American Journal of Distance Education* 11:8-26. Quoted in Saba, Farhad, 2000. Research in Distance Education: A Status Report. *International Review of Research in Open and Distance Learning*, 1:3.

Horn, Dennis. 2000. Panel Discussion 6<sup>th</sup> Annual Instructional Technology Conference. 25 March, at Potsdam State College, Potsdam, New York.

Kanuka, Heather, and Terry Anderson.1998. Online Social Interchange, Discord, and Knowledge Construction. *Journal of Distance Education*, vol 13.

Kennedy, D. and R. Powell. 1976. Student progress and withdrawal in the Open University. *Teaching at a Distance* 7(November): 61-75. Quoted in Saba, Farhad, Research in Distance Education: A Status Report. (International Review of Research in Open and Distance Learning, 2000) 3.

McDonald, J., and Gibson, C.C. 1998. Interpersonal dynamics and group development in computer conferencing. *American Journal of Distance Education* 12:7-25. Quoted in Saba, Farhad, 2000. Research in Distance Education: A Status Report. *International Review of Research in Open and Distance Learning*, 1:3.

Moore, Michael G., 2000. Technology Driven Change: Where does it leave the faculty? *American Journal of Distance Education*, 14:1-6.

Moore, Michael G., 1999. Institutional Restructuring: Is Distance Education Like Retailing? *American Journal of Distance Education*, 13:1.

Moore, Michael G., 1995. Editorial: The 1995 Distance Education Research Symposium: A Research Agenda. *Journal of Distance Education*, 9:1-5.

National Education Association. 2000. A Survey of Traditional and Distance Learning Higher Education Members. Washington, D.C.

Olcott, Don, 1996. Destination 2000: Strategies for Managing Successful Distance Education Programs. *Journal of Distance Education*, vol 9.

Ostman, R.E. and G.A. Wagner, 1987. New Zealand management students' perceptions of communication technologies in correspondence education. *Distance Education* 8:252-258. Quoted in Saba, Farhad, Research in Distance Education: A Status Report. (*International Review of Research in Open and Distance Learning*, 2000) 3.

Polichar, Valerie, and Christine Bagwell, "Pedagogical Principles of Learning in the Online Environment," *Syllabus*, May 2000, 54.

- Rekkedal, T. 1983. Enhancing student progress in Norway. *Teaching at a distance* 23 (summer): 19-24. Quoted in Saba, Farhad, Research in Distance Education: A Status Report. (*International Review of Research in Open and Distance Learning*, 2000) 3.
- Saba, Farhad, 2000. Research in Distance Education: A Status Report. *International Review of Research in Open and Distance Learning*, 1:3.
- Scheuerman, William E., 2000/2001. Keep the reins of technology in faculty hands. *ON CAMPUS*, 11:16.
- Streibel Michael J. 1998. A critical analysis of three approaches to the use of computers in education. Published in, *The Curriculum Problems, Politics, and Possibilities* (Albany: State University of New York Press) 285.
- Tsui, A.B., and Ki, W.W. 1996. An analysis of conference interactions on TeleNex-A computer network for ESL teachers. *Educational Technology research and development* 44; 23-44. Quoted in Saba, Farhad, 2000. Research in Distance Education: A Status Report. *International Review of Research in Open and Distance Learning*, 1:3.
- U.S. Department of Education, National Center for Education Statistics. 1999. *Distance Education of Postsecondary Education Institutions: 1997-98*. Washington, D.C.: Government Printing Office.
- Wallace, Lori, 1996. Changes in the Demographics and Motivation of Distance Education Students. *American Journal of Distance Education*, 9:13.
- Whittington, N.1989. *Is instructional television educationally effective? A Research Review*. Quoted in M.G. Moore and G.C. (Eds.), *Readings in Principles of Distance Education* (University Park, PA: American Center for the Study of Distance Education), 53-63.
- Willis, Barry, ed.1994. *Distance Education Strategies and Tools*. New Jersey: Educational Technology Publications.
- Winograd, David M. 2000. The Effects of Trained Moderation in Online Asynchronous Distance Learning. Ph.D. diss., Arizona State University, Arizona.



# Implementing a Laptop Program at a Small, Liberal Arts University

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## Abstract:

In the fall of 2000, the University of the Incarnate Word, a small, Catholic, liberal arts university located in San Antonio, Texas became the largest IBM ThinkPad University in the South. At present, 2000 laptops have been distributed to students and faculty. This paper will explain the implementation process and the components that made this a successful program. Commitment from the University leadership, involved corporate partners, a broad-based planning team, effective communication, faculty training and a supportive infrastructure lead to a positive first year experience for students. The paper discusses problems that were encountered and makes recommendations to institutions that might be considering such an initiative.

## Introduction:

In the fall of 2000, the University of the Incarnate Word became the largest IBM ThinkPad University in the South. At present, 2000 laptops have been distributed to students and faculty. This paper will explain the implementation process and the components that made this a successful program. Commitment from the University leadership, involved corporate partners, a broad-based planning team, effective communication, faculty training and a supportive infrastructure lead to a positive first year experience for students.

The University of the Incarnate Word (UIW) is a small, Catholic, liberal arts university located in San Antonio, Texas. The University enrolls 4,283 students, of which 3,519 are undergraduates. Seventy-one percent of UIW's student population can be designated as minority. The student population reflects that of the city, with the majority coming from Hispanic (54%) households. Most of the students are first-generation college attendees who use financial aid to pay for their education (77%). The University qualifies as a Hispanic Serving Institution.

Based on our student demographics, the UIW leadership has had a great concern about the increasing "digital divide" between the Anglo and the minority populations. In August 2000, the U.S. Commerce Department reported in *Falling Through the Net: Toward Digital Inclusion*, that the national average for computer ownership was 51%, but the penetration rate was only 33.7% for Hispanics households. The report indicated that the most Hispanics access Internet services from schools, libraries and work rather than from home. (Only 16.1 % of Hispanics access the Internet from home.) With technology use patterns such as this, if UIW did not provide the students it serves with access to technology, who would?

At the University of the Incarnate Word, technology literacy is seen an important part of the liberal arts core curriculum. Students are required to take a course in computer literacy and the integration of technology into courses in the major is standard instructional practice. For many years, there has been budgetary support for infrastructure improvements, the creation of computer labs and for technology skill development among faculty. Still, it had been difficult to keep up with the increasing demand for access to technology. The student to computer ratio was high, there were not enough staff to keep labs open 24/7 and there was the expense of refreshing the technology every 3 years. Requiring students to have laptops seemed like a good solution to these problems. The question raised, however, was how could the program be affordable for our students who already have trouble paying tuition?

## Initial Planning

In the fall of 1999, a Laptop Planning Team made up of faculty, administrators, staff and students was charged with investigating the potential of a pilot program that mandated laptop purchases for all junior and senior business majors (500 students). The Dean of the Business School was trying to respond to a recent employer survey, which indicated that employers considered technology skills a major factor when hiring business school graduates. The Laptop Planning Team identified three goals for the program: (1) put standardized technology into the hands of the students; (2) embed technology into the learning experience; and (3) give students the required technological skills to make them successful after graduation.

Initially, the team used the Internet and telephone interviews to survey other universities that had laptop programs. The Dean and the Chief Information Officer visited the small, Catholic St. Gregory's University in Shawnee, Oklahoma, which has had laptop program since 1997. Major laptop vendors (IBM, Toshiba, Dell, Gateway, Compaq) were asked to do presentations. The Laptop Planning Team prepared a report for UIW's President. After reviewing the recommendations, he decided to expand the pilot beyond the business students to ALL fulltime sophomores and juniors, an estimated 800 students in the Fall 2000.

Through a competitive procurement process, in which a formal request for proposal was prepared and sent to each of the five major vendors, IBM was selected as UIW's corporate partner. IBM's proposal included leasing the laptop computers over a 3-year period, technical support for broken computers, and insurance in case of theft. The laptop chosen was sufficiently robust to connect to the campus network and to run standardized productivity software. IBM offered additional support in sharing their experience with other ThinkPad universities. They provided such assistance as sample letters to students and parents, examples of laptop orientation materials and information on policies and strategies used by other schools. In addition, IBM representatives became a part of our Laptop Planning Team. Our IBM representative drove down from Austin every two weeks to attend the team meetings.

The team determined that each student would receive a laptop, a printer and a backpack. This would eliminate the need to install networked printing stations around campus. In addition, each laptop would have a standard software installation. A Microsoft Campus site license was purchased so that faculty could expect all students to have the basic productivity tools. Standardizing hardware and software would allow the technical support staff to limit the problems that typically occur when dealing with differing configurations. The need for more technical staff was factored into the plan. The team estimated the cost of the lease and the necessary support to be about \$1,100 per year. The University leadership made a major commitment to finance the program by providing a \$300 technology grant each semester so that students had to only pay \$500 per year for their laptop. At the end of 3 years, students would be able to purchase the laptop for \$1. IBM has reported that UIW has the lowest priced ThinkPad University program in the United States.

The University Board of Trustees approved the plan in the spring of 2000 for implementation that fall. Getting the word out to the students about the program was a challenge. Students were informed through various means, including direct mail, student forums and via a web site (<http://www.uiwtx.edu/~Laptop>). A Laptop Appeals committee was established to deal with students who felt that they should be exempt from the program. Currently, all recruitment literature has been revised to include the laptop program and the University extensively advertises itself as an IBM ThinkPad University.

## **Laptop Deployment**

During the summer months of the first year, the laptop orientation session was planned. It was planned as a 2-hour session where students would be given their laptops, check inventory, sign the leasing agreement, plug in and connect to the network, set up their machine for networking and e-mail and informed of computer policies and services. The sessions would be held in a wired lecture hall that held 65 students. Our intent was to keep the distribution session small so that there would be enough technical support. Students had to register for the sessions at the laptop web site. The orientations were scheduled for the week before school started. Unfortunately, due to a delay in manufacturing the new ThinkPad model, these sessions had to be delayed until mid-September. Students were contacted by mail and by phone concerning the delay. To make up for the situation, IBM agreed to provide a wireless card for free with each of the laptops.

The laptops were distributed in 18 orientation sessions, which spread over a 4-week period. Representatives from the technology services, financial aid, business office, student body and IBM manned the distribution stations and served as technical support. One lessoned the team learned was that not all students are willing to pick up their laptops, even though they are being charged for them. Many missed the sessions for which they had registered. Therefore, additional small orientations had to be scheduled. There were also those who delayed until their appeal to the Laptop Appeals Committee was heard.

## **Preparing the Faculty**

The student laptop distribution was only part of the University plan. During the first year of the program, all 138-fulltime faculty received laptops. A Hispanic Serving Institution Title V grant allowed UIW to offer extensive technology training to faculty during the summers of 2000 and 2001. More than 50% of the faculty have

participated in the Title V training. On-going training during the regular school year, a technology fellowship program and instructional technology support staff have helped faculty to integrate the laptops into their teaching.

Another means of pushing integration has been the implementation of Blackboard 5 (Level One), a course management software package. The product has proven to be easy to learn; and has been adopted by an overwhelming number of faculty (62%). Three 2-hour workshops introduced 60 faculty to Blackboard before the Spring 2001 semester. Last summer 40 faculty participated in a weeklong seminar, which focused on online pedagogy as well as provided hands-on experience with Blackboard. At present, there are 2,000 students taking 120 Blackboard enhanced courses (an 82% increase from the spring semester). The University intends to migrate to the portal solution, Blackboard 5.5 (Level 2), during the Spring 2002 semester. Blackboard is changing the instructional environment, and the way in which instructors and students communicate. With the portal product, the University expects to draw the entire community to one place where students, faculty and staff go to find information, to communicate and to get support.

## **Infrastructure & Support**

Having 2000 additional computers on campus has forced UIW to enhance the infrastructure - not only in terms of the network, but also in terms of software and technical personnel. In the summer of 2000, the campus was 48% wired; now it is 100% wired. A decision was also made to implement wireless networking in the library, in classroom buildings, and in student gathering areas. The University expects to spend \$350,000 over a two-year period to make the entire campus wireless. Recently, the University was awarded a Texas Infrastructure Fund grant of \$100,000 to offset some of the cost. Shortly after the laptops were distributed, the network was working at 100% capacity. Students were taking up all the bandwidth by downloading music, videos and making international phone calls over the Internet. The University has since had to add a packet shaper to prioritize the amount of bandwidth various applications use on the network. A virtual private network has been installed to increase security. The additional strain on the network has caused the University to increase the number of T-1 lines from 1 to 3. Finally, plans are being made to purchase a network sniffer to help the infrastructure staff keep track of how the network is being used.

A newly established Technical Support Services now employs 3 fulltime staff and 10 student workers to support the laptops. Clearly the number of staff pales in comparison with other institutions, but at this point, the workload is manageable. When the staff cannot fix the equipment, it is sent to IBM for repair. However, help desk hours are limited to daytime hours during the standard workweek. To augment support, Technology Services is developing online resources and tutorials so that laptop users can get help 24/7 via the Internet. Building renovations were completed to create a space for the technicians and for storage of laptops. A walk up help desk area was created and a gated room was outfitted with wire mesh on the walls and ceiling so that large quantities of laptops could be securely stored.

In addition to office renovations, changes are planned for the classrooms. A laptop classroom is being created with a counter that surrounds the perimeter of the room with data jacks and plugs for 25 laptops. With laptops in the hands of students and faculty, the requests for data projectors in the classrooms have increased. This year \$50,000 from the Title V grant will provide the University with projectors for our main classroom building. As new facilities are planned, projectors and wiring are included in the construction budget. Although the laptops have batteries, providing electricity to old classrooms has become a major concern from faculty who want students to bring their laptops to class.

## **Problems**

Of course, there have been problems with the implementation that were not anticipated. During the first year, student attitudes toward the program were not as positive as expected. Some students refused to pick up their laptops. Many complained openly in student forums and in the school newspaper. However, there has been a change in attitude during the second year. Students were much more excited when receiving their laptops. As an indication, this year 71% of the freshmen opted to get a laptop rather than wait until they are sophomores. Other complaints have come from graduate students and adult degree completion program students who were not eligible for the program but who wanted laptops. IBM has now established a direct purchase program for these students as well as for faculty, staff and alumni. Students who received laptops last year have complained because this year's model is faster and has more capacity. They want a way to return their model and get the newest one. A two-year refresh program would help with this problem, but the University is not prepared to commit to this change at this time.

Students, who graduate or withdraw from UIW, can purchase their laptop. Unfortunately, some students drop out without notification and without returning the laptop. In the orientation, students are warned that felony charges will be filed against them if they fail to return their laptops upon leaving school. The practice is to send these students two letters requesting the return of the laptop and a final certified letter demanding the laptop back. The first year there were 12 such incidents. Our response was to file charges with the police department and the district attorney's office. Regrettably, the local district attorney has decided that criminal intent was not evident in these cases and that the matter should be handled in civil court. Complicating matters further, is the fact that laptops are being leased from IBM, who actually owns the laptops. Admittedly, the University does not yet have a successful and easy solution to this problem.

The University has found a solution for what to do with the returned laptops. The University has offered the leasing option for the "used" laptops to departments within the institution. This allows them to spread the cost of the laptops over two budgetary years, making it more affordable. The laptops are insured for theft and have the IBM asset protection plan, which makes the offer more attractive. The adult degree completion program and the high schools that are associated with UIW are planning to outfit several laptop labs using these machines.

### **Lessons Learned**

The UIW experience has much to offer any institution that is interested in implementing a laptop program. The UIW Laptop Planning Team could offer this advice.

1. Form a planning team made up of representatives from all of the university constituencies who are impacted by the program. Expect to meet regularly through out the year.
2. Research what other schools have done and do site visits to schools that are similar in size and budget.
3. Carefully prepare a request for proposals for laptop vendors that allow the team to make comparisons. Look for vendors that are willing to do more than just sell laptops at a good price. Consider experience, support and commitment. Look for a service plan and a way to insure the equipment.
4. Standardize the hardware and software selection so that it is easier to integrate into the classroom experience and so that it easier to service.
5. Use a variety of methods to inform students and parents about the project. Expect complaints about the program and develop mechanisms for appeals.
6. Prepare the faculty by giving them the laptops first and by providing training to support the integration.
7. Expect to upgrade the infrastructure. The students will be using the network in ways that will eat up bandwidth.
8. Expand the technical support services on campus. Do not put together a plan without making this a part of the budget.
9. Spend time on the orientation plans. More time spent with the student during orientation means less time spent on service problems later.
10. Develop accessible instructional materials to help students use the technology. Do not expect them to pick it up on their own or to get it in class.
11. Find a killer application such as Blackboard to push the use of technology into the classroom and into the lives of the university community.
12. Plan for classroom arrangements and technology to support students and faculty taking laptops into the classrooms.
13. Develop policies to handle the problems such as non-returned laptops and acceptable computer use.
14. Be patient and flexible. Changes do not occur overnight and some unanticipated problem will always come up.

The University is now in its second year of the laptop program. Despite the problems that have occurred, the University leadership is committed to keeping the program. The mission of the institution states that "The University is committed to educational excellence..." and is "open to thoughtful innovation that serves ever more effectively the spiritual and material needs of people." The laptop program is supportive of this mission. It puts technology in the hands of students, who otherwise would not have access. Laptop ownership gives students the tools they need to complete their academic programs and allows them to develop the skills needed to compete when they leave the institution.

### **Reference**

*Falling through the net: toward digital inclusion.* Retrieved October 1, 2001 from U.S. Department of Commerce and National Telecommunications and Information Administration Web site:  
<http://www.ntia.doc.gov/ntiahome/ftn00/contents00.html>

# Community of Practice: What is it, and how can we use this metaphor for teacher professional development?

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## Abstract

*In this paper I provide the reader with the definitions and characteristics that are often associated with the community of practice metaphor. Then I propose that community of practice is an appropriate tool for descriptive research or improving the interactions that take place in a community, but not necessarily an appropriate instructional tool for designing and developing learning communities in schools. I demonstrate this by reporting on findings from a case study of a teacher professional development program for technology curriculum integration*

## Introduction

In the past decade community of practice has become a popular term in both educational and business settings. Many of its implications are in alignment with situated learning theories, sociocultural learning theories, and organizational learning theories. Community of practice as a metaphor provides researchers with a theoretical lens for explaining why members of a community do what they do in everyday settings, and how community members define practices and engage in identity formation. The notion of community of practice provided the educational research community a method for explicating cultural knowledge that is often times a tacit set of rules and rituals that function as a lens through which members of a community view and interpret the world and give order, significance and meaning to their experiences (Maynard, 2001). The endorsement that community of practice has won in the field of educational research represents the ideological shift that occurred during the late 1980s where researchers began to express their interest in examining learning in everyday settings rather than school settings (see Brown, Collins, & Duguid, 1989; Lave, 1988; Resnick, 1987; Rogoff, 1990).

Consequently, there has been a plethora of research surrounding community of practice in both educational and business settings. Many of these efforts have been based on research using ethnographic methods. The outcomes of these ethnographic studies have helped identify the characteristics and mechanisms of community of practice especially how it influences organizational learning and individual learning. Thus within educational research community of practice has become an interesting and useful metaphor for describing and understanding organizational learning. However, for the community of practice metaphor to mature as a research and development framework in educational settings, we need more discussions surrounding how it can be used as a metaphor for improving preservice and inservice teacher education. This manuscript will specifically focus on inservice teacher professional development.

The charge of this manuscript is to: (a) reexamine the definitions and characteristics that are often associated with the community of practice metaphor; (b) clarify that this metaphor is a theoretical tool for educational researchers make sense of interactions that take place in educational settings; and (c) use the community of practice metaphor as a theoretical lens to reflect on interactions that took place at a rural Midwestern school district that was involved in a teacher professional development program. I will conclude with suggestions on how to use community of practice as an instructional design tool for supporting and enhancing organizational learning. The data presented here has been extracted as a portion of a larger multiple case study that took place in two rural Midwestern school districts during August 1998 to May 2000.

## Literature Review

Community of practice is a term popularized by Lave and Wenger (1991) when they examined the legitimate peripheral participation of apprentices in professional communities. They claimed that apprentices of a community of practice are given legitimate roles within the community, and their actions have a direct consequence for the entire community. As an apprentice gradually appropriates the skills that are necessary for her to become a more skillful member of the community, she is assigned legitimate tasks that have greater consequences. Within this theoretical framework, communities of practice consist of groups of individuals with common goals who are engaged in joint activities in a common setting. The way that work related activities are exercised in a community of

practice affects the way that its members view the world, and it also defines the legitimacy of a task practiced in the community. Lave and Wenger (1991) define the term as follows:

A community of practice is a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice. A community of practice is an intrinsic condition for the existence of knowledge, not least because it provides the interpretive support necessary for making sense of its heritage. Thus, participation in the cultural practice in which any knowledge exists is an epistemological principle of learning. (p. 98)

Additionally, the history and experiences shared in a community of practice defines what constitutes competence within that community (Wenger, 2000). In other words, the shared experiences within a community define the legitimacy of practices that are carried out on an everyday basis.

Interestingly, the focus of Lave and Wenger's work was not to identify and define the notion of a community of practice. They focused their work on illuminating the setting, processes, and individuals involved in professional communities, such as the Yucatec midwives and naval quartermasters. Lave and Wenger introduced the notion that community members consist of newcomers and old-timers, and the learning activities involved for a newcomer to transition to an old-timer is extraordinarily situated in the everyday practices of the community contrary to learning experiences that K-16 learners face in schools. Lave and Wenger used community of practice as a descriptive metaphor in their anthropological studies involving legitimate peripheral participation to portray how a community makes meaning of the world and how the world and individuals' identities are defined by the history and practices shared by the community members. Lave and Wenger never made any claims from the implications of their study about how to constitute community of practices in educational settings (Palincsar, Magnusson, Marano, Ford, & Brown, 1998).

Wenger (1998) further examined the concept of community of practice. In his 1998 work he provided definitions of community, practice, and identity formation within a community. He reported that community practice is an integral part of our daily lives, and it is everywhere. Communities of practice do not have a name or a membership card, but members of a community of practice identify themselves as a "we" defined by the joint participation for attaining a common goal. This notion of "we" draws boundaries between multiple communities of practices, and these boundaries can act as an important agent for learning systems because they connect communities and offer opportunities for learning (Wenger, 2000). Community members that cross over to another community of practice are exposed to practices and artifacts that are new to them. These new experiences can allow individuals to engage in activities that they never did prior to the boundary crossing. Then these individuals can bring back their newly negotiated understandings to their original community by becoming the brokers of the new practices (Wenger, 1998).

Wenger (1998) cautions that community of practice is not a new solution to existing organizational problem, and "they are not a design fad, a new kind of organizational unit or pedagogical device to be implemented" (p. 228). Wenger further explains that:

Communities of practice are about content—about learning as a living experience of negotiating meaning—not about form. In this sense, they cannot be legislated into existence or defined by decree. They can be recognized, supported, encouraged, and nurtured, but they are not reified, designable units. (p.229)

Finally, Wenger (2000) cautions researchers not to romanticize the notion of community of practice. At the same time that a community of practice supports learning, it can also be the mechanism that enables individuals to learn the practice of not learning. Therefore, a community of practice is not necessarily always advantageous for human everyday practices.

The field of educational research quickly adopted community of practice as a conceptual tool for both research and instructional design. As a research tool community of practice has been used to identify individual identity formations and interindividual interactions that take place within a classroom setting or a broader educational setting (see Matusov, 1999, 2001; Maynard, 2001). As an instructional design tool community of practice has been introduced as an architectural guideline of instructional environments as used in Barab and Duffy (2000) and in Palincsar et al. (1998). However, in these instances the authors stumbled into situations where they realized that community of practice could not be used as a pedagogical device for designing communities in K-16 education or in teacher professional development. For example, Barab and Duffy used community of practice as the overarching metaphorical notion for providing K-16 students a highly situated and authentic learning environment. Thus, they point out the shortcomings of using community of practice as an architectural tool of learning environments because the experiences learners encounter in school settings are alienated from the real problems that community of practices encounter. To alleviate this shortcoming Barab and Duffy suggest instructional designers to use the notion of practice fields (Senge, 1994) in K-16 educational settings.

Palincsar et al. (1998) used community of practice as a design tool for tracking the birth and growth of a community within a teacher professional development program that focused on improving classroom practices of K-5 teachers specifically in the area of science education. However, the above authors point out themselves that it is difficult to use community of practice as an instructional design tool for professional development because within the everyday work life of teachers there is a lack of a commonly shared mission or a joint enterprise (Hargreaves, 1993), and teachers lead individualistic and isolated work lives (Little, 1990), where they do not necessarily feel as they are a member of a community of practice. Ironically the attempts for using community of practice as an instructional design tool for architecting educational environments have reinforced Wenger's (1998) position that community of practice is not a designable unit. Instead, community of practice is a useful tool for identifying and supporting community efforts in order to improve and assist the educational efforts of a group of individuals.

## **This Study**

### **TICKIT**

This study took place in the context of a teacher professional development program about technology curriculum integration. The program that the study participants were involved in was the Teacher Institute for Curriculum Knowledge about Integration of Technology (TICKIT). TICKIT is a university school partnership between five rural Indiana schools and Indiana University. Each year, in this program there are at least 25 teachers enrolled, and they are responsible of developing, implementing, and evaluating at least two lessons that integrate technology in their subject area. During their participation, TICKIT participants are provided support from Indiana University staff and their local schools for integrating technology into their everyday teaching activities and for becoming technology leaders in their schools. In exchange, upon completion of all projects required in TICKIT, teachers receive six graduate credit hours that can be used toward either a master's degree or for revalidating their Indiana teaching license.

## **Methods**

### **Participants**

The initial participants of this study were selected from (a) school districts that enrolled in TICKIT for two consecutive years during the 1998-1999 and 1999-2000 school year, and (b) school districts that provided support for participant teachers. The primary participants were individuals who were: (a) TICKIT 1998-1999 participants who were classroom teachers, and (b) TICKIT 1998-1999 participants who participated in the entire yearlong program. The secondary participants were non-TICKIT teachers, administrators, technology coordinators, or technology support staff. Anonymity of the study participants was maintained by the use of pseudonyms for individuals and school district names. For the purpose of this manuscript, I will present a portion of the entire data from the Hillsdale-Berkley School District. At the Hillsdale-Berkley School District there were four primary participants, including two eighth grade teachers, one sixth grade teacher, and one third grade teacher, and five secondary participants, including two teachers, one media specialist, one technology coordinator, and one technology support person.

### **Researcher Role**

The above participants and I were well acquainted with each other during this study because I was the TICKIT graduate assistant that maintained the website, conducted technology related workshops for participants, and provided any other assistance requested by the program coordinators or TICKIT participants. Therefore, there were moments during this study when I took the role of more than an outside observer. For example, when there were inservice technology sessions at the Hillsdale-Berkley school district, the teachers were very eager for me to participate, partly for my data collection purposes and partly so that I could help them with teacher training.

### **Data Collection Methodology**

In this research, naturalistic inquiry methodology (Lincoln & Guba, 1985) was used, where the data collection took place in a natural setting and there were no variables manipulated in anticipation of confirming a hypothesis. More specifically, I conducted a case study (Merriam, 1998; Stake, 1995). The data collection methods included document analysis, interviews, and classroom observations with 1998-1999 TICKIT participants, non-participating teachers, and school technology support staff.



## **Trustworthiness**

I attempted to maintain the trustworthiness of this qualitative study by: (a) prolonged engagement with the research site, (b) persistent observation, (c) triangulation, and (d) member checking. Although this research began after the TICKIT 1998-1999 program, I had close ties with the participants during TICKIT 1999-2000. Therefore, I had a total of two years of engagement with the research site.

## **Data Presentation**

### **School District Background**

Hillsdale-Berkley School District is a rural Midwestern school system with minimal industry in the community. The district serves six schools (four elementary schools, one middle school, and one high school). Due to the rural environment in which the school is situated, it is isolated from many educational resources, such as public libraries and museums that could be available in more urban settings. The district's mission is to "encourage and direct the physical, mental and social growth of each student... so he can, to the best of his abilities, become a well adjusted, contributing member of our society" (Hillsdale-Berkley School District Technology Implementation Plan 1997-2001).

For the past five years the Technology Planning Committee, which is a district-wide committee, has been planning for the technology implementation plan. The mission of this committee is to "create, implement, evaluate and revise a long-range technology plan for learning that will move the students of the schools well into the 21st century" (Hillsdale-Berkley School District Technology Implementation Plan 1997-2001). The district acknowledges that electronic technology has become an integral part of the function of the community. Therefore, their goals state "learners and teachers will develop the skills necessary to effectively utilize technology ethically and creatively in serving both the individual and society" (Hillsdale-Berkley School District Technology Implementation Plan 1997-2001).

However, many of the technology related initiatives, such as applying to various state grants and implementing technology in the curriculum, have been efforts pursued by pockets of enthusiastic teachers rather than a movement led by district administrators and staff. The common practice for gaining grant money, at the Hillsdale-Berkley School District, works such that the school library media specialist finds grant applications that fit a single or several teachers' needs; then the teacher will apply for the grant individually or with the media specialist's help. Therefore, grant application preparations are considered as extra workload for teachers, and they usually spend time after school hours to write grants. When the teacher or groups of teachers gain the grant money, it is distributed for their classroom use and not necessarily for school-wide initiatives

### **Hillsdale-Berkley School District and TICKIT**

At the Hillsdale-Berkley School District, prior to enrolling in TICKIT, there were several self-motivated teachers experimenting with the use of technology in their classrooms. These teachers were interested in using technology, because when the integration was successful, it oftentimes provided a rich learning environment for students, and students were motivated to learn in this technology rich environment. The school district did not have funds for providing teachers with technology in their classrooms; therefore, the technology enthusiastic teachers applied for small grants that allowed them to provide the hardware and software in their classrooms.

Hillsdale-Berkley teachers worked in interdisciplinary teams, but technology related activities were contained within the boundaries of the classroom. Consequently, teachers did not develop the practice of sharing physical resources such as equipment and software or sharing teaching related ideas and stories. Furthermore, teachers that were not comfortable in using technology in their classroom did not consider the enthusiastic teachers' efforts as curriculum development. They perceived activities related to technology curriculum integration to be a hobby-like activity.

For some teachers at the Hillsdale-Berkley School District, participating in TICKIT gave justifications for non-TICKIT participating teachers to acknowledge the TICKIT participants' efforts. By participating in TICKIT, the teachers' efforts in integrating technology into the curriculum and prioritizing them over other teaching responsibilities were well accepted by non-TICKIT teachers. Becoming participants of a university school partnership program gave renewed sense of credibility to the activities surrounding technology that the Hillsdale-Berkley TICKIT participants were engaging in. For example, during her interview Naomi, an eighth grade Language Arts teacher, commented that when she shared the projects she completed in TICKIT with her non-TICKIT participating colleagues on her team, the project was acknowledged as an important curriculum unit and not "Naomi's computer project."

it's accepted better. It's not "oh...it's Naomi's computer project" now it's like "oh, their doing the WebQuest project." Which is a big difference...if it's my little project on the computer it's not valid. It's just that thing she does, but if it's a WebQuest, suddenly it's like part of the curriculum and they see educational value that they did not before. I think that changed the attitude a little bit. (Naomi, Primary Participant Interview, February 29, 2000)

This acknowledgement by non-TICKIT teachers, that the TICKIT participating teacher projects were part of the curriculum and not just a computer project, encouraged a change in attitude of the non-TICKIT teachers, and some became excited to participate in their schools' curriculum technology integration efforts.

At the end of the program, the Hillsdale-Berkley teachers felt that they gained new technology skills that made them feel more comfortable and confident in using various technologies in their classroom. With their newly gained confidence and technological skills, teachers at the Hillsdale-Berkley School District became eager to incorporate technology into their classroom. Deborah, an eighth grad Math teacher, commented on this in the following excerpt: "being comfortable of using the Internet ... being able to create Web pages...did a lot to me in making me feel comfortable...and try to do things for my students..." (Deborah, Primary Participant Interview, March 8, 2000). Furthermore, Alice, a sixth grade Language Arts and Social Studies teacher, felt that her newly gained confidence energized her and made her eager to continue to work on integrating technology in her classrooms. She mentioned during her interview that: "I am always thinking about ways [to integrate technology in the curriculum], what can I do, what can I do" (Alice, Primary Participant Interview February 2000). However, Hillsdale-Berkley teachers realized that there was not enough equipment for them to use in their day-to-day teaching, especially in the Middle School.

With the new sense of confidence, new university connections, and camaraderie shared among TICKIT teachers at Hillsdale-Berkley, teachers became eager and excited to apply for new technology-related grants. As the non-TICKIT teachers at the district witnessed several of the TICKIT projects and found that the school was purchasing more equipment they became interested in using technology in their own classrooms. Some non-TICKIT teachers even chose to enlist themselves in TICKIT for the 1999-2000 year.

The TICKIT 1998-1999 teachers continued to influence their non-TICKIT participating colleagues by taking a leadership role during inservice teacher training sessions and by making themselves available for helping other teachers. Emma, the media specialist, commented how the five TICKIT participants from her school have been helpful to other teachers.

They've been helpful in helping people design other things too, and getting their Web page going or you know, designing a WebQuest too, so they've been good resources people. (Emma, Secondary Participant Interview, April 16, 2000)

For example, during February 2000, Emma coordinated a two session series of after-school inservice programs for teachers at Hillsdale-Berkley Middle School on Web publishing. Henry, a third grade teacher who participated in TICKIT, was the instructor for the inservice session, and many of the participants of the session were TICKIT 1998-1999 teachers. I observed the second day of one of these sessions, where teachers brought in the curriculum they wanted to publish on the Web and worked on it while Henry and Emma assisted in answering questions.

The first day of the in-service, according to Emma, was a typical training session where Henry demonstrated how to use Netscape Communicator. The second session was designed for teachers to bring their recent Web publishing projects and use the inservice time as work time. The TICKIT participants other than Henry who were present at the inservice were helpful in answering other teachers' questions while they were working on their own projects as well.

## **Discussion**

When examining the historical development at the Hillsdale-Berkley School District prior to TICKIT, teachers enthusiastic about using technology in the classroom had to isolate themselves from their day-to-day teaching colleagues if they wanted to develop and implement technology infused curriculum. Within the everyday practice of teaching at Hillsdale-Berkeley, curriculum technology integration was not acknowledged as a legitimate teaching related practice.

Teaching efforts surrounding technology use in the classrooms were perceived by other teachers as indulging in hobby-like activities that satisfied individual interests rather than meeting curriculum needs with pedagogical values. Additionally, indulging in such "illegitimate" practices were potentially threatening to a teacher's career because it could have discredited their teaching as a whole by other local teachers. Inevitably, the self-motivated teachers that were enthusiastic about integrating curriculum and technology had to isolate themselves

from the local boundaries of their teaching colleagues and choose not to share their ideas and stories regarding technology implementation with local colleagues.

While participating in TICKIT Hillsdale-Berkley teachers found other teachers interested in sharing and legitimizing the common goal of designing, developing, implementing, and evaluating new methods for using technology in the classroom that addressed curriculum and student needs. Based on the partnership build by becoming a TICKIT participant, these colleagues included teachers from their school district and outside of their school district, and university faculty. Here, the teachers from Hillsdale-Berkley found a new group of individuals to associate with while they excused themselves from their local colleagues. In this way, TICKIT introduced to them new peers for Hillsdale-Berkley TICKIT teachers to work together to develop technology-integrated lessons.

After TICKIT, once the Hillsdale-Berkley teachers attained their goal of a successful curriculum technology integration project, they became boundary brokers (Wenger, 1998) between the TICKIT community and their local community of teachers. After completing the program, TICKIT teachers from Hillsdale-Berkley brought to their local community new artifacts (i.e. successful curriculum technology projects) and stories surrounding those artifacts. These new artifacts and stories of TICKIT teachers acted as catalysts that encouraged other teachers to become involved in TICKIT for the following two school years.

Additionally after TICKIT, Hillsdale-Berkley teachers found a group of local teachers and technology staff who shared their vision for school-wide curriculum technology integration. These teachers wrote grants together to acquire funding that would support purchasing technology equipment and professional development activities for local teachers. Ordinarily, the community has great influence over shaping the everyday practices that teachers choose to engage in because the community defines the rules and division of labor associated with practices. However, as seen in the above example, community endorsement is not the sole predictor of success.

Innovations that are introduced to everyday practices of teachers, such as a professional development program, can change the perception of local practices, and legitimize new teaching related practices that were formally illegitimate. For example, after TICKIT technology enthusiastic teachers in Hillsdale-Berkley no longer needed to isolate themselves from their local colleagues because the activities surrounding the use of technology in classrooms became legitimate. Therefore, TICKIT teachers did not need to belong to an outside group to attain their technology curriculum integration goals. They became a self-sustained group of teachers that shared a common goal and were acknowledged by many of their local colleagues as technology leaders in the district.

Through the above examination there are several transitions that can be identified. These transitions include the following: (a) the non-TICKIT teachers perception of TICKIT teachers' everyday efforts for integrating technology into the curriculum changed from a hobby-like illegitimate teaching practice to a legitimate curriculum development; (b) TICKIT teachers' perception of their own skills and confidence regarding technology use in the classroom changed from being mediocre and timid users of technology to skillful and bold users, and (c) the TICKIT teachers' identity changed from a closet technology user in the classroom to a technology leader in the district. The key artifact that became the catalyst for the above transitions was the TICKIT participating teachers' curriculum technology integration projects. These projects served the purpose of reified objects that helped institutionalizing and legitimizing new practices at the Hillsdale-Berkley school district.

## **Conclusion**

In this manuscript I presented community of practice as a useful tool for examining interactions that take place in professional development settings in order to understand everyday practices within a teacher community and to identify what practices are perceived to be legitimate and what practices are not. Teacher professional development involves introducing and legitimizing new practices within the teaching community. In some cases, such as in this study, professional development programs can assist in nurturing and enhancing practices that are already practiced within a small group of teachers in a school district by introducing the non-practicing teachers to new artifacts that are reifications of legitimate pedagogical practices.

Using community of practice as a tool for examining local teaching practices within a school district can help universities, school districts, and teachers involved in a professional development program identify what are the accelerators and barriers of success for introducing new pedagogical practices. Once this is identified it is the task of the professional development program and its participants to leverage the local practices to identify methods for legitimizing new teaching related activities. Therefore, community of practice can be used as a theoretical lens for identifying, supporting, and strengthening practices that already exist in school districts. This will then assist school districts to develop robust and pedagogically sound educational practices.

In conclusion I suggest that in professional development settings universities, school districts, and teachers use community of practice as a metaphor for analyzing current practices and developing strategies for infusing new

practices to a school district. As the works of Barab and Duffy (2000) and Palincsar et al. (1998) suggest, there are limitations for using community of practice as guidelines for designing and developing new learning environments in educational settings. Therefore, in future research there is a need for examining the advantages and shortcomings of using community of practice as a tool for designing and developing educational environments.

## References

- Barab, S. A., & Duffy, T. (2000). From practice fields to communities of practice. In D. Jonassen & S. Land (Eds.), *Theoretical foundations of learning environments* (pp. 25-55). Mahwah, NJ: Lawrence Erlbaum Associates.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18, 32-42.
- Hargreaves, A. (1993). Individualism and individuality: Reinterpreting the teacher culture. *International Journal of Educational Research*, 19(3), 227-246.
- Lave, J. (1988). *Cognition in practice*. New York: Cambridge University Press.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York: Cambridge University Press.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: SAGE Publications.
- Little, J. W. (1990). The persistence of privacy: Autonomy and initiative in teachers' professional relations. *Teachers College Record*, 91(4), 509-536.
- Matusov, E. (1999). How does a community of learners maintain itself? Ecology of an innovative school. *Anthropology and Education Quarterly*, 30(2), 161-186.
- Matusov, E. (2001). Intersubjectivity as a way of informing teaching design for a community of learners classroom. *Teaching and Teacher Education*, 17(4), 383-402.
- Maynard, T. (2001). The student teacher and the school community of practice: A consideration of 'learning as participation'. *Cambridge Journal of Education*, 31(1), 39-52.
- Merriam, S. B. (1998). *Qualitative research and case study applications in education: Revised and expanded from case study research in education* (2nd ed.). San Francisco, California: Jossey-Bass Publishers.
- Palincsar, A. S., Magnusson, S. J., Marano, N., Ford, D., & Brown, N. (1998). Designing a community of practice: Principles and practices of the GiSML community. *Teaching and teacher education*, 14(1), 5-19.
- Resnick, L. B. (1987). The 1987 presidential address: Learning in school and out. *Educational Researcher*, 16(9), 13-20.
- Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. New York: Oxford University Press.
- Senge, P. (1994). *The fifth discipline fieldbook: Strategies and tools for building a learning organization*. New York: Doubleday.
- Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage Publications, Inc.
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York: Cambridge University Press.
- Wenger, E. (2000). Communities of practice and social learning systems. *Organization*, 7(2), 225-246.

# Family Characteristics of Authentic Materials and Activities in Constructivist Learning Environments

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## Abstract

*In the constructivist literature, the use of authentic materials and authentic activities as tools of meaningful learning is repeatedly emphasized. Using Wittgenstein's concept of family resemblance as a framework, I conducted an extensive study of the authentic activities and materials used in three elementary classrooms in Des Moines, Iowa. The presentation will be based on analysis of interviews, observations, field notes, and student portfolios using NVIVO, a qualitative software package. In recent years, educators all around the world have been searching for new approaches to teaching and learning. In both developed and developing nations, many policy makers as well as educators are emphasizing more than ever the importance of education. The constructivist perspective is one valuable response to these concerns about finding alternatives to traditional teaching methods. It is also an area of cutting-edge applied research.*

## Introduction

Authenticity, in fact, is one of the main characteristics of constructivist learning environments (CLE). There are many theoretical discussions of authentic learning, and many lists of the theoretical and conceptual characteristics of authentic learning materials and activities. However, there is very little research on the actual characteristics of 'authentic' materials and activities as they are used in real classrooms. Are the actual characteristics similar to or different from the theoretical characteristics described in the literature? This paper addresses this question and compares what I found in the classrooms studied to the theoretical characteristics of authentic learning described in literature. The concept of family resemblance, which was developed by the philosopher Ludwig Wittgenstein (1953, 1958), has been used as a framework for understanding the concept of authentic materials and activities.

## The Notion of "Family Resemblance"

This study researches the family characteristics of CLE using the notion of 'family resemblance'. The "family resemblance" concept was developed by Austrian philosopher Ludwig Wittgenstein (1889-1951). In his book *Principal Investigations* published posthumously in 1953, he discusses language philosophy in detail. In his early studies "he tended to take an essentialist view of common nouns: the view that there must be some common element in all cases in which we apply such a word, something that regulates our use of it for all those cases" (Brenner 1999, p.23). However, the later Wittgenstein challenged this requirement by describing counterexamples, starting with the noun 'game' (1953):

"Consider ...board games, card games, ball games, Olympic games, and so on... If you look at them you will not see something that is common to all, but similarities, relationships, and a whole series of them at that (PI, #66)."

Here Wittgenstein (1953) makes a straightforward statement of fact: "if we examine those things we call games, we will not find any single property in virtue of which they are called games; instead we find that they are grouped together by a whole series of overlapping similarities akin to family resemblances".

The family resemblance concept of Wittgenstein fits perfectly with constructivist theory and helps orient studies like this one. In this study I was looking for family resemblances, not universal traits. So the features mentioned below are not the common features of all three classrooms I observed all the time. Rather, they are often found, and taken as a group they constitute a set of family resemblances.

## Setting of the Study

For this study data were collected in three different elementary school classes. The classes were drawn from two different school districts in the Des Moines, Iowa area. These classes were selected through an extensive

process that began with seeking recommendations from professors and school administrators. These sources recommended a large pool of classrooms that were considered “constructivist.” I interviewed 15 teachers and observed in their classrooms. Many classrooms were not actually using constructivist teaching strategies and were rejected. Eventually, three were found that regularly used constructivist teaching strategies including authentic instruction. The teachers in these three classrooms were all well known for their regular use of authentic materials and activities, and preliminary observations confirmed this.

There were two teachers from the same school district who participated. Their school uses the Multi-Age Classrooms (MAC) concept. The first teacher (#T1) taught a class with grades 3, 4 and 5 in the room whereas the second teacher (#T2) taught first and second graders in her room. They were both very experienced teachers, and had masters’ degrees. The third teacher (#T3) was from another school district and she taught only third graders.

During a seven week period in October, November, and December 2000 I visited these classes each school day. I videotaped all the class time with single digital camera. When conducting the interviews, I also used the video camera with the permission of teachers and parents. After my visits to classes I took field notes on a daily basis in order to clarify the videotapes’ content.

Once the data were collected I used NVivo, a popular qualitative data analysis program to code and analyze the data.

## Results

*Family Characteristics:* There are several characteristics of constructivist learning environments in which authentic activities and materials are used regularly. First, teachers use real life materials in order to stimulate deeper understandings. Second, the meaningful learning experiences are the basis of most but not all activities in the three classrooms studied. Third, there are many learning centers in which students practiced hands-on activities. The focus of instruction is on learning in contexts instead of learning in “out of context.” All the activities were developmentally appropriate to the cognitive level of students and the teachers helped students adjust activities to their personal levels of development. Thus, these classrooms tended to be what some have termed “child-centered” as well. Technology use and integration in these classrooms was also a very distinguished feature. There were also other characteristics, such as differences in the physical environment or and differences in the teachers’ roles which made these classrooms innovative.

*Constructivist Theory Versus Constructivist Practice:* My observations in classrooms, plus interviews with teachers and students, indicates there is a strong relationship between constructivist theory and practice. Teachers rarely use direct instruction methods which are often criticized by constructivist theorists. Instead, they use a variety of student centered instructional approaches. However, while theorists tend to present the image of constructivist teaching and learning as exclusive, my study clearly shows that the teachers do occasionally use traditional methods such as drills and objective tests. These were used infrequently, but they were used. The teachers, who were aware of constructivist theory and had extensive experience in “teaching constructively,” seemed comfortable using traditional methods occasionally. However, these methods did not characterize or define the classroom experiences of students.

*Constructivist Methods Versus Traditional Methods to Learning:* The classrooms studied are considered good examples of constructivism. However, I regularly observed traditional methods in these learning environments. There may be many reasons for this. Perhaps it is very difficult use constructivist methods all the time. Perhaps teachers are concerned that the traditional expectations of what schools should accomplish, such as high scores on standardized tests, calls for traditional methods. Perhaps it is difficult to collect the resources needed for constructivist teaching. Or, perhaps constructivist teachers still see a place for traditional methods. They have not replaced traditional methods with constructivist methods; they have, instead, made constructivist methods their primary approach and they continue to use traditional methods because they see a place for them in the classroom.

Another reason for limited use of constructivist teaching is the school environment. The third teacher I observed, for example, wanted to do more than she was doing. However, she felt other teachers and her principal had concerns about constructivist approaches. This teacher used the most traditional methods and the fewest constructivist approaches. The other two teachers, who were in schools where innovative teaching was the norm, and where they were encouraged and supported by other teachers and administrators, were much more likely to experiment.

*Authentic Materials Versus Instructional Materials:* Even though the classrooms studied might be considered as constructivist learning environments which involve the use of authentic activities and materials, I also regularly observed the use of traditional instructional materials. For example, in language arts classes students regularly read storybooks, some of them assigned by the teacher and some selected by students. The activities

students engaged in (e.g., reading to other students, finding the meaning of words they do not understand, discussing the story with others) fall within the broad constructivist framework but the storybooks themselves are not necessarily “authentic: materials. However, as stated by Cronin (1993) assuring that all learning materials are “authentic” is not the purpose of authentic learning. Instead it is important to use authentic materials and activities as much as makes educational sense. Thus, the use of authentic materials is as regular but not continuous characteristic of the classrooms studied. Authentic materials are a family characteristic that will be seen some of the time, but not all the time.

## References

- Brenner, W. H. (1999) “*Wittgenstein’s Philosophical Investigations*”. NY: State University of New York.
- Cronin, J.F. (1993) “Four Misconceptions about Authentic Learning”. *Educational Leadership* 50 (7). Alexandria, VA: Association for Supervision and Curriculum Development.
- Wittgenstein, L. (1953) *Philosophical investigations*. New York, Macmillan.
- Wittgenstein, L. (1958) “Preliminary studies for the “Philosophical investigations”. (Generally known as The Blue and Brown books). Oxford, B. Blackwell.

# Comparing Teachers' and Parents' Mental Models for Teaching Hearing-Impaired Children to Speak

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## Abstract

*In order to understand the cognitive and affective roots underpinning the differences between teachers' and parents' teaching approaches for hearing-impaired children, this study proposes a four-level analysis structure (global-level schema, middle-level schema, local-level schema, and propositional reasoning) to construct and then compare teachers' and parents' mental models for teaching. The outcomes of this comparison reveal many fundamentally different perceptions and attitudes about teaching between teachers and parents, which often result in ineffective communication between the two. Therefore, it is suggested that to improve the effectiveness of instruction between teachers and parents in special education, one needs to understand how teaching exceptional children is mentally represented before any intervention is designed.*

## Introduction

In special education, while teachers have the expertise of teaching children with special needs, parents, usually unprepared for such a daunting task, are the ones who execute the teaching tasks and help children to learn everyday. Therefore, it is a common practice for teachers to train parents to teach their children. However, the training's ineffectiveness often puzzles the teachers. It is a commonly shared feeling among teachers that teaching parents is more difficult than teaching children because it requires a lot more persuasion, reminding, and rectification to help parents to accept and to internalize the teaching approaches. Parents, on the other hand, often find it difficult to completely accept teachers' approaches. An important reason is that the disparity between being a parent and being a teacher to a child is often concomitant with different perceptions of teaching, which often results in different teaching styles. For example, parents have been observed to incline to provide more intense instruction (Rogoff, Ellis, & Gardner, 1984), to use more controlling and straightforward styles to manage children's activities, and to be more performance oriented (Wertsch, Miick, & Arns, 1984). Moreover, this disparity also exerts a significant impact on the extent to which parents identify themselves with teachers' teaching approaches. Apparently, when factors like parental expectations, responsibilities, relationship with the child, etc. are amalgamated with teaching, parents often develop a different view from teachers. Especially when the child requires special care, the effects of all these factors seem to be intensified; therefore, more divergent teaching styles are expectable. However, surprisingly few studies have been conducted to understand how differently teachers and parents think about teaching children, in particular, with special needs. As a result, questions such as "Why parents ignore teachers' advice?" and "Why teachers have trouble communicating a pedagogical notion to parents?" are left answered. In order to answer these questions, this study intends to delve into teachers' and parents' mental models to present and then to compare how the notions of teaching are internally represented in teachers' and parents' minds.

## Mental Models

Although it has been widely adopted and studied by many researchers, there is no consensus of the definition of the term "mental models" (Hong & O'Neil, 1992). In general, the following features of mental models have been described in the literature:

First, mental models are internal representations that we construct in mind for the message or event that we encounter (Norman, 1983; Johnson-Laird, 1983). Such representations should be "essentially problem-oriented, not encyclopedic in nature, and are bound to be incomplete or underspecified" (Sanford & Moxey, 1999, p.74). That is, they present an analogous structure to the represented entities (Johnson-Laird, 1983; 1989) instead of an identical mirror image in our mind.

Second, mental models are explanatory constructs (Johnson-Laird, 1983). Once the internal representation has been created in our mind, it begins to influence the way we see, interact with, and reason about the world (Greeno, 1989; Dutke, 1996), and to make us experience events by proxy (Johnson-Laird, 1983, p. 397).



Third, mental models have computational capabilities (Greeno, 1989; Wilson and Rutherford, 1989). Especially for discourse comprehension, such computational processes are often represented by propositional reasoning (Anderson, 1993; Johnson-Laird, 1983).

Finally, mental models are schema-based (Driscoll, 1994; Dutke, 1996; Rouse & Morris, 1986; Wilson & Rutherford, 1989; Johnson-Laird, 1983). Sanford and Moxey (1999) further argue that the notion of mental model would be void if it is not rooted in background knowledge.

What these features imply is that by mapping the perceived message or entities to our background knowledge, our mind constructs a prior-knowledge interpreted representation of the given message, which not only presents itself as the surrogate reality for the message in our mind, it also formulates the premises under which we reason and make inferences. Given the close link between mental models and schema, to complete the theoretical discussion of mental models, it is important to understand the construct of schema first.

## Schema

Originally defined by Barlett (1932) as “an active organization of past reactions, or of past experiences, which must always be supposed to be operating in any well-adapted organic response” (p. 201), schemas have been described as unconscious mental structures (Brewer, 1987) that contain networks of “interrelations... hold among the constituents of concepts in question” (Rumelhart, 1980, p. 34). Essentially, according to Minsky (1975), it is a construct that organizes our prior knowledge in a hierarchical structure that contains networks of nodes and relations. While the top-level nodes are “fixed, and represent things that are always true about the supposed situation” (p. 212), the bottom-level nodes contain automatically assigned default values that stipulate the conditions that the incoming data have to meet in order to be accepted. These default values--the declarative knowledge represented by propositions --function as premises that rule our reasoning processes (Johnson-Laird, 1983). Based on these propositions, people reason in the format of if-then productions, which serve as the building block of human cognitive operations (Anderson, 1983; 1993). Those proposition-based declarative knowledge thus become the joints where the mental model theory dovetail with the schema theory and thus formulate the integrated internal representation through which we perceive and understand the world.

In this study, the integration of schema and mental models is presented by a four-level structure, i.e., global-level schema, middle-level schema, local-level schema, and proposition reasoning, as will be discussed below.

## Methodology

All the data were collected in the Children’s Hearing Foundation in Taiwan, a non-profit organization that provides free Auditory-Verbal therapy (Auditory-Verbal International, 1991) and audiology services for hearing-impaired children. To answer the question “Given the same aspiration of helping children to learn as effectively and efficiently as possible, and the same teaching strategy (Auditory-Verbal approach), why and how teachers and parents still teach differently?” purposive sampling was used to select and recruit parents on the basis of the following three criteria: (a) they must have attended the CHF’s lessons for at least one year; (b) they must be the primary care-takers and committed to the task of teaching their children to speak; and (c) they accept and value the importance of the Auditory-Verbal approach. Three mothers and their corresponding teachers were invited to participate in the study. Information about these teachers, parents, and children is tabulated in Table 1.

Children & mothers	Joey & his mother	Kyle & his mother	Tony & his mother
Age (child /mother)	5 / mid 30	5.5 / mid 30	5 / mid 30
Siblings	Only child	Has a younger brother (also hearing impaired)	Has an elder sister (with normal hearing)
Mother’s education	College	College	College
Years in the CHF	2 years and 9 months	1 year	1 years and 6 months
Child’s hearing loss	Severe-to-profound / Cochlear Implant	Moderate-to-severe / Wearing hearing aids	Profound / Cochlear Implant
Corresponding teachers	Jill	Karen	Tina
Age	Late 20	Late 20	Late 30
Marriage	Single	Single	Mother to 2 boys
Years in the CHF	3 years	1 year and 6 months	1 years and 6 months
Time with the child	2 years and 9 months	1 years	6 months

Table 1. Background information of the three teachers, three mothers, and three children.

### **Data collection**

After participants were recruited and before any data collection process began, the researcher spent two weeks in the foundation to get acquainted with participants in order to build a mutual trust. Over the span of three months, interviews, observations, and stimulated recalls (Bryan, Bay, Shelden, & Simon, 1990; Anthony, 1994; Clark & Peterson, 1986; Van Noord & Kagan, 1976) were conducted. All of the interviews and recalls were audiotaped, transcribed, and translated from Chinese to English. An external audit (Lincoln & Guba, 1985) was invited to ensure the accuracy of the transcriptions and translations.

**Interviews:** Two interviews for each participant were conducted: one at the beginning and one at the end of the data collection processes. The interviews were open-ended in nature to elicit a holistic picture of participants' perceptions of teaching.

**Observations:** For each teacher-parent pair, two therapy sessions at the CHF which contain representative episodes or interactions that evidenced certain thinking processes were videotaped and fully transcribed.

For each mother, two teaching sessions at home were videotaped and fully transcribed. To reduce the intrusion, the researcher and the video camera were far away from the teaching site as much as possible.

### **Stimulated Recall on Videotapes**

After each videotaped session ended, the teachers (for the CHF sessions) and mothers (for CHF and home sessions) were asked to reflect on the videotape right after the sessions ended. The purpose of the stimulated recall was to (a) reconfirm the researcher's observations, (b) allow participants a chance to organize and reexamine what they thought and felt in the sessions, and (c) expose hidden messages that were otherwise not observable in the interactions.

### **Data analysis**

In this study, two types of data were collected: (a) what people did, and (b) what people said. The fieldnoted videotape transcriptions were first broken down into different activity groups, e.g., reading a story. The constituent unit behaviors and their relations within each exchange of verbal or bodily language were first identified, coded, and represented by boxes and arrows. These intra-activity models are called micro-level interaction models. After all micro-level interaction models are completed, patterns of people's launching and reacting to an interaction across different teaching activities emerged. These emerged patterns are thus constructed into inter-activities models, called macro-level interaction models, in the format of flowcharts to represent people's knowledge of conducting a certain teaching procedure. Because this model concerns knowledge of procedures that are directly related to conducting a teaching activity, it constitutes the local-level of the schema of teaching.

After all the interview and recall data were transcribed and verified by the participants, they were first distilled into propositions. As the gradation of their relations to a specific teaching behavior emerged, these propositions were divided into three-level schema to represent the hierarchy of thoughts.

**Global-level schema:** composed of essential attributes (Wilson & Rutherford, 1989, p. 623) that represent prototype (Hampton, 1991; Medin, 1978) conceptualization of teaching that emerged from data as the quintessential notions of a typical thinking mode that formulates the central tendency of a person's conceptualizing a teaching task in a genuine yet context-free teaching scenario. In reference to Krathwohl's affective taxonomy (Krathwohl, Bloom, & Masia, 1964), this is analogous to the "generalized set".

**Middle-level schema:** composed of themes or beliefs that were repetitively voiced by the participants as the bottom-line principles that they hold on to as a guidance for reasoning or behaving toward a certain situation. This is corresponding to "commitment" in Krathwohl's affective taxonomy.

**Local-level schema:** composed of the network of context-bound and teaching-behavior-related propositions that represent the declarative knowledge (Anderson, 1983) of conducting a certain teaching procedure. This local-level schema from verbal data will be matched with the one from observation data (macro-level interaction models) on the basis of corresponding constituent behaviors so that the actions and the knowledge embedded in each action are integrated.

**Propositional reasoning productions:** as every teaching task-related proposition implies a goal to achieve, which is commonly derived from the global- and middle-level schema, propositions with the same goal are first grouped. The goal serves as the condition, the "if" part, of an if-then production (Anderson, 1993), and these propositions make the action, the "then" part (or counter-examples as pointed out by Johnson-Laird, 1983). These

constituent behavior based if-then productions therefore represent the underlying cognitive operations of each teaching behavior.

After analyzed with this framework, the teachers' and parents' mental models for teaching are compared and the most significant differences are presented as follow.

## Results

Due to similar training and education backgrounds, a striking consistency was found among the three teachers' data. Therefore, these data were combined as one and compared to the three mothers' individual data on the basis of the four-level mental model framework. However, to avoid redundancy, at the three-level schemas, teachers' and the three mothers' models are compared at the same time; but to reveal the individual differences, the teachers' propositional reasoning models are compared with each of the three mothers' individually. The following are the outcomes of the comparison.

### Comparison of Global-Level Schema

The teachers' and the three mothers' global-level schemas--the prototype conceptualization of teaching--are characterized as language-oriented (the teachers), performance-oriented (Joey's mother), activity-oriented (Kyle's mother), and child-oriented (Tony's mother). For the teachers, what all the professional knowledge eventually boils down to is a two-in-one concern: how to improve children's auditory and verbal abilities. While interacting with a child, resorting to all the techniques and strategies at the back of their mind, the teachers' thoughts were entirely anchored on applying the Auditory-Verbal approach to the ongoing interactions to help the child learn. In other words, the prototype conceptualization of the teachers' mental processes was centered on the notion of developing children's auditory and verbal abilities surrounded by the techniques and strategies that realize it. In contrast, the notions that the mothers gravitated toward while interacting with their children were related to what they think they need to do to help their children learn the most effectively and efficiently. For Joey's mother, the thought that dominated her teaching mind was "how to let Joey learn as much and as effectively as possible"; therefore, imitation, correction, and full concentration were the core features of the prototype. For Kyle's mother, the prototype of the teaching mind centered on "how to stimulate Kyle's reasoning ability in natural interactions". Q & A interactions, modeling correct answers, and conducting various activities were the core features. Finally, for Tony's mother, the prototype of the teaching mind centered on "how to seize the moment to input language expressions for Tony to listen to and learn". Around it, the core features consist of observing Tony's behavior, incessantly input language expressions, and pleasant interactions. These prototypical schemas not only identify the core of different people's reasoning processes, more importantly, they point out the driving forces that shape people's efforts and set the tone for perceiving interactions.

### Comparison of Middle-Level Schema

The comparison of the teachers' and mothers' middle-level schemas, i.e., attitudes and values, reveals the following differences.

1. **Meaningful interaction:** There was a consensus belief among participants that language teaching is meaningful only when children pay attention to it. However, the approaches of getting their attention onto the target language objects varied significantly. The teachers and Tony's mother used rewards to trade for children's attention and cooperation, whereas Joey's mother and Kyle's mother usually resorted to demanding or warning. Such a difference is derived from two assumptions of teaching: (a) teaching is to capitalize on any learning opportunity that the child's attention allows; and (b) teaching is to dictate the desirable learning behaviors that the child should enact.
2. **Expectations:** The teachers based their expectations for children on their current abilities and took other developmental factors into account. Kyle's mother based her expectations on what she thought to be reasonable for children of Kyle's age to accomplish. Joey's mother based her expectations on what she thought to be necessary for Joey to achieve. Tony's mother closely follows the teacher's lead and based her expectations on the progress that Tony made in learning each individual language target.

3. Pleasant learning interactions: The teachers and Tony's mother believe that fun and learning can and should go hand in hand, whereas Joey's mother and Kyle's mother would rather separate the two and concentrate on the learning outcomes while in lessons. For Joey's mother, nothing was more important than getting Joey ready for school. She would do anything to push and help Joey improve his language ability, having fun excluded.
4. Productivity in contrast to effectiveness of learning: The mothers shared the same goal of making every lesson as productive as possible; the difference was how to accomplish it. For Joey's mother, being productive means getting more accurate responses from Joey, so she would keep correcting and pushing him until he gave a correct response; for Tony's mother it means striving for more opportunities for conducting verbal interactions with Tony, so she would never stop talking while she was with Tony; and for Kyle's mother, it means more cognitive stimulations for Kyle, so she would constantly ask Kyle questions. The teachers, on the other hand, look for effectiveness besides productivity. The effectiveness that they look for is a good-quality learning process that naturally brings out good learning outcomes in a pleasant and natural learning atmosphere.
5. Time pressure: All of the mothers shared the same eagerness to help their children to learn as fast as possible. In one way or another, they expressed their fear that time with their children was too precious to be wasted on things that do not have direct impact on their children's learning. The teachers empathized with such stress and anxiety, but those emotions were not evidenced in the way they taught in the therapy sessions or interviews. Most of the time, what concerned the teachers was whether or not the child had made progress over time. In contrast, what concerned the mothers was whether or not their children were going to be fine in a mainstreamed school.
6. Begin with approaches in contrast to begin with children: The teachers rooted their thinking about teaching on the teaching approaches and tailored them to meet individual child's learning needs, whereas the mothers began with their assumptions of their children's learning propensities and customized the teaching approaches for their children. The difference is that the former may lose sight on the mismatch between teaching approaches and children's learning behaviors, whereas the later may preclude the children from new effective learning experiences.
7. Professional knowledge in contrast to experience: When the mothers' experiences were at odds with the teachers' professional knowledge, the teachers' advice was often disregarded. It was observed that the mothers were more open to advice regarding technical aspects of the approach which may generate more observable effects such as strategies for stimulating children's speaking and listening abilities than conceptual aspects, such as principles for shaping children's behaviors. Especially when the mothers felt their approaches had led to a certain reasonable success in the past, it was hard for them to take the teachers' advice to their hearts.
8. Natural interactions: While teachers believed that learning naturally accumulates in normal-yet-language-targets-focused interactions, the mothers did not entirely trust the processes, or at least did not regard it as enough. The didactic nature derived from their own educational experiences often led the mothers to address the learning duties that the children had to fulfill during casual interactions. That is, in addition to normal exchanges of language, the mothers expect more specific learning outcomes and emphasize learning efforts such as memorization from the children.

### **Comparison of Local-Level Schemas**

The local-level schemas, represented by networks of teaching actions, were broken down to sub-networks that represent different parts of the entire teaching procedure. Teaching behaviors and the patterns of their relations are compared between the teachers' and the mothers' schemas.

1. Before lessons begin: The atmosphere and settings of the CHF environment are designed to elicit the best learning performance from children. Having come to the therapy sessions for at least a year, the children knew what was going to happen and how they were expected to behave in sessions; therefore they were usually more psychologically prepared for the teachers' activities. In contrast, it was more difficult for the mothers to wait and seize the children's motivated moments and squeezed in language-focused interactions on a twenty-four hours basis. Therefore, sometimes the mothers had to acquire the children's attention by more forceful way.

2. Provide verbal stimuli: Once an activity was chosen, the interactions usually began with a verbal stimulus. Two differences were observed in the way that the teachers and mothers presented the verbal stimuli by the Auditory-Verbal approach. First, given their trust and acceptance of the approach, the mothers did not exercise it as proficient as the teachers did. The reason may be due to negligence or implicit resistance to certain techniques (e.g., a mother said “I didn’t provide reinforcers because children need to learn to study independently whether having a reinforcer or not). Second, the teachers have a lot more flexibility in changing materials or activities than the mothers. This is because that the teachers have more teaching resources than the mothers while the mothers have more predetermined teaching objectives for the lessons.
3. Problem-solving processes: Believing that children need to learn to solve problems by themselves, the teachers often intentionally brought children into a problem-bound situation, in which the teachers facilitated the thinking process and carefully associated children’s problem-solving behaviors with language. This effort was not observed in the mothers’ teaching schema. The mothers either predicted the consequence of children’s actions to keep children from making mistakes or told them what to do right after the problem occurred.
4. Incorrect response: The three mothers demonstrated three styles of handling their children’s inability to respond to stimuli. Joey’s mother accepted nothing but accurate responses; therefore, regardless of Joey’s motivation level, she would keep asking Joey to try until he could respond correctly. Kyle’s mother preferred natural interactions, so she would add only one or two extra clues and then disclosed the correct response quickly. Tony’s mother primarily concerned about inputting language expressions for Tony to listen to and learn; therefore, instead of correcting his mistake, she would follow his reaction and verbally describe his response for him. On the other hand, the teachers would break down the stimulus, add extra clues, or repeat the stimulus to help the child understand. Meanwhile, they always checked on the children’s motivation levels to avoid building any association between adverse emotions and learning.
5. Non-verbal response: When the children gave non-verbal responses, the teachers and Joey’s mother would try to help the children respond verbally. Kyle’s mother usually did not notice the difference. She would accept non-verbal responses and comment on the accuracy of the responses. Tony’s mother would help Tony to respond verbally only when he had demonstrated the ability of saying it correctly in the past.
6. Intelligibility check and imitation: Upon receiving a verbal response from a child, the teachers and mothers had to check its intelligibility to decide if an imitation was needed. Joey’s mother always asked Joey to imitate the accurate words or phrases repetitively until he did it right. Tony’s mother only asked Tony to imitate when she knew that he had done it before. Kyle’s mother did not ask for imitation very often, but when she did, she would correct her children’s tongue positions in addition to having the children listen and imitate. The teachers would ask children to imitate only when children were ready to do it, and only do a few rounds of practice to avoid stressing children out. In addition, visual cues were used when nothing else worked and would be taken away immediately after the pronunciation was correctly made.
7. Reinforcement, expansion, feedback, and turn-taking: All of the participants believed in the effectiveness of reinforcement, so they more or less would give children rewards or compliments when they performed well. The feedback that the teachers and Tony’s mother provided in reaction to the child’s response included repeating the child’s responses and providing evaluation on its accuracy in a positive way. Joey’s mother and Kyle’s mother usually provided only judgment. With the possible exception of Kyle’s mother, all participants would try to expand the children’s language whenever possible. Turn-taking was a technique that the mothers seldom apply at home.

### **Comparison of Propositional Reasoning Processes**

In order to reveal the differences between the teachers’ and the mothers’ mental models in detail, each of the three mothers’ propositional reasoning processes is compared individually to the teachers’.

#### **Joey’s Mother and the Teacher:**

- 1) Academic oriented in contrast to language oriented: If Joey’s mother/teachers want to help Joey to keep up with other children in school,
  - a) Joey’s mother will teach him the academic materials in advance.
  - b) The teachers will focus on helping him to establish good language ability first.

- 2) Push for maximum performance in contrast to leading into best performance: If Joey's mother/teachers want to help Joey learn as much as possible,
  - a) Joey's mother will keep talking to him, correct every mistake he makes, and keep pushing for a good imitation until he gets it right.
  - b) The teachers will provide motivators to stimulate his learning interests, and conduct language-focused interactions in designed activities or normal daily communications.
- 3) Demand him to do it right in contrast to help him to do it right: If Joey gives an incorrect response but Joey's mother/teachers believe Joey can and want to help him respond to the question correctly,
  - a) Joey's mother will feel unacceptable, raise her voice to demand his full attention, repeat the same question, and be reluctant to provide more clues because she does not like to lower the standard.
  - b) The teachers will reexamine his standing in the course of language development and rephrase or provide more clues to help him respond correctly.
- 4) Make the child to learn effectively in contrast to look for effective teaching for the child: If Joey's mother/teachers want to help Joey to learn effectively,
  - a) The mother will create a serious learning atmosphere and demand complete concentration to make him take learning seriously to learn effectively.
  - b) The teachers will identify where his attention is at and present prioritized language-focused interactions in a meaningful way to either attract the child's attention or to follow it.
- 5) Ignore distraction in contrast to capitalize on distraction: If Joey's mother/teachers want to help Joey learn as much as possible but are disrupted by an unexpected incident in a lesson,
  - a) Joey's mother will consider the incident as a distraction, and will ignore it and bring Joey's attention back to the planned lesson as soon as possible.
  - b) The teachers will capitalize on the incident and associate it with corresponding language expressions.
- 6) Eliminate the negatives in contrast to capitalize on the positives: If Joey's mother/teachers want to help Joey learn from the mistake he made,
  - a) The mother will incessantly correct any mistake he made and resort to punishment to keep him from making the same mistake again.
  - b) The teachers will emphasize the correct part of the response, associate it with the desired response, or directly model the correct response when such association does not work.
- 7) Model solution in contrast to guide thinking processes: If Joey's mother/teachers want to help Joey to learn how to solve a problem,
  - a) Joey's mother will verbally or physically model the solution for him to imitate and learn, and expect him to memorize it.
  - b) The teachers will provide more visual or verbal cues to help him understand the problem and facilitate the thinking process to guide him to solve the problem successfully.

#### **Kyle's Mother and the Teacher**

- 1) Activity-oriented in contrast to language-oriented: If Kyle's mother/teachers want to help Kyle learn through an activity,
  - a) Kyle's mother will primarily focus on the activity itself and try to generate successful outcomes out of it.
  - b) The teachers will try to create relationships among people, objects, or the surroundings in the activity to demonstrate different language features.
- 2) Reading in contrast to meaningful interactions: If Kyle's mother/teachers want to help Kyle learn different language expressions,
  - a) Kyle's mother will teach by reading books.
  - b) The teachers will associate the language expressions with Kyle's personal experiences
- 3) Quantity of interactions in contrast to quality of interactions: If Kyle's mother/teachers want to improve Kyle's general language abilities,
  - a) Kyle's mother will conduct more language interactions with him to compensate for her relatively unfocused language interactions.
  - b) The teachers will conduct language-targets-focused language interactions with him and expose him to an environment abundant with reasonably advanced language features.
- 4) Make transition to the future in contrast to do what is working now: If Kyle's mother/teachers want to get Kyle to learn,
  - a) Kyle's mother will provide no motivators other than verbal encouragement because that is what happens in schools.

- b) The teachers will either present a motivator in advance or provide reinforcers afterward to elicit good learning behaviors.
- 5) Memorization in contrast to comprehension: If Kyle's mother/teachers want to teach Kyle a new concept,
  - a) Kyle's mother will describe it for Kyle to listen to and have him memorize it.
  - b) The teachers will provide more visual or verbal cues to bridge the gap between the stimulus and the child's cognitive level, and facilitate the thinking process to guide the child to comprehend successfully.
- 6) Memorization in contrast to role playing: If Kyle's mother/teachers want to help Kyle learn different language expressions related to different roles,
  - a) Kyle's mother will model the expressions for him to memorize and hope that he practices on his brother.
  - b) The teachers will have the child play different roles and help him learn the language expressions associated with those roles.
- 7) Warning and punishment in contrast to enticing motivation: If Kyle's mother/teachers want to get Kyle to concentrate on the lesson,
  - a) Kyle's mother will warn him and let him know that she will be mad if he does not behave.
  - b) The teachers will provide motivators or change to a more interesting activity.
- 8) Combination of approaches in contrast to Auditory-Verbal approach only: If Kyle's mother wants to help her children make an accurate pronunciation,
  - a) Kyle's mother will model the correct pronunciation and its basic elements for him to imitate first, and then correct his tongue position.
  - b) The teachers will help him learn to make accurate pronunciation by associating the sound they modeled for him with the sound he made.

### **Tony's Mother and the Teacher**

- 1) Need to know the child's progress in contrast to trust the processes: If Tony's mother/teachers want to design activities for Tony to learn something,
  - a) Tony's mother will design activities that begin with commands or questions for him to respond to test how well he understands her.
  - b) The teachers will present abundant language expressions in accordance with his language capabilities to establish his habit of listening.
- 2) Language learning with top priority in contrast to language learning grounded in integrated child education: If Tony's mother/teachers want to keep Tony staying in an activities so he can learn,
  - a) Tony's mother will keep him from feeling frustrated, tolerate poor manners of learning, and allow him to have more rewards than he deserves so he will enjoy the activities.
  - b) The teachers will teach him how to deal with frustration, fairness, and accept no inappropriate behaviors.
- 3) Ride on his inappropriate response in contrast to insist the right way to respond: If Tony's mother/teachers want to help Tony learn when he intentionally ignore the accurate response and responding to stimuli the way he wants,
  - a) Tony's mother will forget about the stimuli and tries to associate his incorrect response with corresponding language expressions instead.
  - b) The teachers will first make sure the stimulus has been clearly presented, and second, make sure he learn and demonstrate the association between the stimulus and its appropriate response correctly at least once.

### **Discussion**

While the global-level schema describes the context-free prototype conceptualization of teaching, middle-level schema represents participants' general values about teaching, local-level schema describes the context-specific teaching procedures, and propositional reasoning represents the cognitive computations behind each teaching behavior. Based on this four-level framework, the comparison of three teachers' and three mothers' mental models reveals striking differences. Given the fact that the teachers and the mothers shared the same goal, i.e., to help their children to learn language as effectively and efficiently as possible, and that they all highly value the importance of the Auditory-Verbal approach for their children, what these differences show is that training is not about delivering knowledge but about transforming a cognitive system. If such transformation takes place only at local-level schema, e.g., learning the techniques of the Auditory-Verbal approach but not the attitudes toward the nature of children's learning, the newly learned will be interpreted in accordance with the existing value systems, and the outcomes of such training will often be different than the trainers would have expected. Oftentimes, what

matters to a child's learning experiences is not how accurate a teacher or mother can execute a teaching technique, but the subtle facial expressions, pace, tone of speech, bodily language that reflect a person's fundamental attitudes that are conveyed through executing these techniques. While training a subject matter whose application is inseparable of personal attitudes and subjective-decision making, understanding how the subject matter is mentally represented is crucial for the success of the training.

Furthermore, all the descriptions of the teachers' and the mothers' lower level schemas should be viewed in the perspectives of higher level schemas. On the other hand, propositional reasoning, although demonstrated as closely attached to a particular unit behavior, is actually operated on the basis of the whole schema system. Therefore, this four-level framework represent four aspects of the internal representations that we construct for comprehending the encountered entities in an integrated yet dynamic format.

Finally, the comparison outcomes show that, comparing to the mothers, the teachers are more process-oriented, flexible yet prepared, and fun-driven. They believe in enhancing the positive performance and adjusting their approaches to deal with children's lack of progress or learning motivations. With these teaching inclinations as the platform for the language-oriented prototypical teaching mind, which sets the direction for cognitively processing interactions, all the thinking and teaching behaviors gravitate toward building children's auditory and verbal abilities in the way in accordance with Auditory-Verbal approach. On the other hand, the mothers are more outcome/performance-driven, and goal-minded. Joey's mother's performance-oriented teaching mind results in a error-eliminating, negatively reinforcing, highly controlling type of teaching style, which concerns mainly about how accurate Joey's responses are and how serious that Joey's learning attitude is. Kyle's mother's activity-oriented teaching mind result in an activity-abundant yet language-unfocused teaching style, which compensate for less skillfully conducted interactions by increasing the quantity of interactions. On the other hand, Tony's mother's child-oriented teaching mind generates a fun-loving, encouraging, everything-for-language-interactions style, which weighs eliciting Tony's learning motivation over many other equally important developmental concerns. What these differences indicate is that people conceptualize the task of teaching in different ways. They value different aspects or outcomes of teaching, and thus are more open to information that is based on the same predispositions of teaching. Developed from their personal learning experiences, expectations, or maternally instincts, these teaching predispositions constitute the personally-defined optimal teaching package that they believe is for their children. It not only takes a lot of mutual understanding and empathy to make clear what the differences really are about, it also takes a lot of acclimatization to do something different from what they have accustomed to do.

Revealing these background knowledge-rooted internal representations of teaching is to improve the mutual understanding between teachers and parents. Especially in special education where parents' teaching efforts are crucial for children's development, when the mothers' perceptions of teaching are intricately intertwined with parental expectations, responsibilities, feelings of guilt, and attitudes toward the child's handicap, teachers' unawareness of these background issues may result in totally off-the-mark interactions between teachers and parents. A study of three teachers and three mothers does not bear too much generalization contribution. However, the intricacy and the integrity of mental models could not be demonstrated with reasonable power of representativeness if no lengthy and in-depth qualitative data collection and analysis procedures are conducted. This study intends to propose a framework for representing mental models, and to build three teachers' and three mothers' teaching models as a window for understanding how teaching is conceived during teaching. The next step is to take these information as a given and figure out the way of promoting the effectiveness of interactions between teachers' and parents' models.

## References

- Anderson, J. R. (1993). Rules of the mind. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Anthony, G. (1994). Learning strategies in the mathematics classroom: What can we learn from stimulated recall interviews? New Zealand Journal of Educational Studies, 29(2), 127-140.
- Auditory-Verbal International (1991). Auditory Verbal position statement, The Auricle, 4(4), 11, 15.
- Bartlett, F. C. (1932). Remembering. Scientia, 52, 221-226.
- Brewer, W. F. (1987). Schemas versus mental models in human memory. In P. Morris (Ed.), Modelling cognition (pp. 187-197). New York: John Wiley & Sons Ltd.
- Bryan, T., Bay, M., Shelden, C., & Simon, J. (1990). Teachers' and at-risk students' stimulated recall of instruction. Exceptionality, 1(3), 167-179.
- Clark, C. M., & Peterson, P. L. (1986). Teachers' thought process. In M. C. Wittrock (Ed.), Handbook of research on teaching (3<sup>rd</sup> ed.) (pp. 255-296). NY: MacMillan Publishing Company.
- Driscoll, M. P. (1994). Psychology of learning for instruction. Boston: Allyn and Bacon.



Dutke, S. (1996). Generic and generative knowledge: Memory schemata in the construction of mental models. In W. Battmann and S. Dutke (Eds.), Processes of the molar regulation of behavior (pp. 35-54). Lengerich: Pabst Science Publishers.

Greeno, J. G. (1989). Situations, mental models, and generative knowledge. In D. Klahr & K. Kotovsky (Eds.), Complex information processing. The impact of Herbert A. Simon (pp. 285-318). Hillsdale, NJ: Erlbaum.

Hampton, J. (1991). The combination of prototype concepts. In P. J. Schwanenflugel (Ed.), The psychology of word meanings (pp. 91-116). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Hong, E., & O'Neil, H. F. Jr. (1992). Instructional Strategies to help learners build relevant mental models in inferential statistics. Journal of Educational Psychology, 84(2), 150-159.

Johnson-Laird, P. N. (1983). Mental models. Cambridge, Massachusetts: Harvard University Press.

Krathwohl, D. R., Bloom, B. S., & Masia, B. B. (1964). Taxonomy of Educational Objectives. Handbook II: Affective Domain. New York: David McKay Company, INC.

Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic Inquiry. California, Beverly Hills: Sage Publications.

Medin, D. L., & Schaffer, M. M. (1978). Context theory of classification learning. Psychological Review, 85(3), 207-238.

Minsky, M. (1975). A framework for representing knowledge. In P. H. Winston (Ed.), The psychology of computer vision (pp. 211-277). New York: McGraw-Hill.

Norman, D. A. (1983). Some observations on mental models. In D. Gentner, & A. L. Stevens (Eds.) Mental models (pp. 7-14). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Rogoff, B., Ellis, S., & Gardner, W. (1984). Adjustment of adult-child instruction according to child's age and task. Developmental Psychology, 20, 193-199.

Rouse, W. B., & Morris, N. M. (1986). On looking into the black box: Prospects and limits in the search for mental models. Psychological Bulletin, 100(3), 349-363.

Rumelhart, D. E. (1980). Schemata: The building blocks of cognition. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), Theoretical issues in reading comprehension (pp. 33-58). Hillsdale, NJ: Erlbaum.

Sanford, A. J., & Moxey, L. M. (1999). What are mental models made of? In G. Rickheit & C. Habel (Eds.), Mental models in discourse processing and reasoning, (pp 57-76). Amsterdam: North-Holland.

Van Noord, R. W. & Kagan, N. (1976). Stimulated recall and affect simulation in counseling: Client growth reexamined. Journal of Counseling Psychology, 23(1), 28-33.

Wertsch, J. V., Minick, N., & Arns, F. J. (1984). The creation of context in joint problem solving: A cross-cultural study. In B. Rogoff & J. Lave (Eds.), Everyday cognition (pp. 151-171). Cambridge, Mass: Harvard University Press.

Wilson, J. R., & Rutherford, A. (1989). Mental models: theory and application in human factors. Human Factors, 31(6), 617-634.

## **Evaluation of instruction (training): It is NOT optional for professionals (or, who screened the baggage on your flight?)**

JennyLynn Werner  
*SixSigma Performance*

### **Abstract**

*Training is a technical term, applicable to interventions that result in a performance outcome, however, the term is often used inappropriately to elevate conglomerations of content to training status even though no performance improvement results or is ever likely to result. Myths about evaluation, that it is optional, or too expensive, or somehow unfair to learners (all false statements) persist because of a lack of competence in evaluation skills on the part of a majority of practitioners. Actually evaluation is a critical component in effective and efficient (and therefore cheap in total cost) training, and it is unfair to learners to expect performance improvement on the job unless the training has been proven through rigorous evaluation. The current rates of change in both technical and non-technical arenas, as well as a slowing economy and tightening budgets contribute to a reality where fewer and fewer people can afford to throw away hours of instruction or training on non-functional conglomerations of content. Rigorous, full evaluation is simply not optional for Instructional Technology professionals.*

### **Introduction**

Although calls for data in the field of Instructional / Performance technology continue from every direction (e.g. Anglin, et al, 2000; IBSTPI, 1998; Gery, 1999; Merrill, et. al, 1996; Shrock, 1999), the number of publications which include meaningful evaluation is not increasing, and may be decreasing (Werner & Klein, 2000). Evaluation is often considered to be optional or too expensive, or is simply not a part of the project from the beginning. Some customers and clients have been misinformed in the past that evaluation is expensive, or unnecessary, or somehow unfair to the learners (all these assumptions are false). In fact, evaluation is not only *not expensive*, it is the cheapest step in the process and the best practice for all involved. It's also not at all time-consuming if the intervention involves observable, measurable performance outcomes and the practice is sufficient and aligned to those outcomes (inherent in the definition of training, so an intervention without observable, measurable outcomes is simply not training). In fact, the most expensive choice anyone could make is to forego evaluation and release dysfunctional or non-functional interventions that then consume vast amounts of resources in terms of organizational resources, material costs, and learner time and effort. In addition, most unmeasured "training" sets learners up to fail - thus impacting their subsequent learning efforts far into the future.

A case study, utilizing a technology-based intervention to address a need for skill development by new hires in a semiconductor fabrication facility (Fab), is provided to illustrate the evaluation process, including summative evaluation, and demonstrates the necessity for evaluation as well as the total value (costs and benefits) of routine and systematic evaluation of interventions. The application of Level 1 (trainee response) data, Level 2 (posttest performance) data, and Level 3 (on-the-job performance) data to revise the intervention until it functions at the required level to meet the business need are described.

### **Foundations**

Instructional technology is the application of expertise (in the areas of human information processing, learning, performance, cognition, etc.) to solve real-world gaps in skills and knowledge through specially designed interventions. It is this expertise, along with effectiveness and efficiency data from previous interventions, that enables us to develop instruction that works for the target audience. Although it seems to be lost on a large number of practitioners, the profession of instructional technology is rooted in observable, measurable performance outcomes, under conditions where the consequences of failure are serious; after all, the application of learning theory to solve real-world problems effectively and efficiently really took off as experts worked with the military to prepare soldiers to fight and survive in many types of warfare (see Gagne, 1989; Dick & Carey, 1985; Anderson, 1995; National Research Council, 1991).

As we work to improve the performance of others, we must role model performance to business indicators ourselves, and demonstrate that discipline around assessment and accountability are fundamental to continuous

improvement. Using our own tools while demonstrating efficiency and effectiveness and performing at least to the levels we demand of others are both critical components of our credibility. Our customers are nearly always held to some level of minimum performance; can you imagine a factory manager who is only measured according to the amount of raw materials going into the factory? For this scenario, actual production of working units is not measured, ever. Training which is not measured according to actual performance outcomes of trainees after training (i.e., training tracked by a body count or attendance, and with opinion surveys) is very analogous to the Factory Manager who is measured only by how much raw material goes into the factory. Our customers and clients deserve better; the standards of our profession demand better (see standards at AECT site, <http://www.aect.org> and at IBSTPI at <http://www.ibstpi.org>; consider reviewing the new ISO requirements for training also). It's impossible for measurement to be superfluous, to be expensive in terms of total cost, or be time consuming in terms of total resources. One basic premise of both Total Quality and Continuous Improvement is that, if you can't measure what you're doing then you don't know what you're doing (measurement is critical to improving both process and product; remember, it's possible to change for the worse). This is so very critical because an intervention isn't training because the word training appears in the title. Training is only training if it functions to enable a permanent (or near permanent) performance change that is observable and measurable.

### **The Premise**

There are clearly issues with the present status of the profession of performance or instructional technology. Training is treated as a joke, as a necessary evil, as too expensive or too difficult to do well, and the low expectations of end users (trainees) and performance owners (managers) enable the practitioners to perpetuate content masquerading as training. The same problems have been discussed over and over in the past twenty years of Training & Development (an American Society of Training & Development publication), as well as in articles published inside and outside the field. The complaints are consistent across the years, and are detailed in articles like: Furnham's *Fire the training department*, (1997), Kruger, & Dunning's *Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments* (1999), and Armour's *Big lesson: Billions wasted on job-skills training* (1998), just to name a few. For example, in a USA Today article, Armour (1998) explains provides some insights, "Faced with crippling skill shortages, employers are spending skyrocketing amounts of money training workers. The problem? Many programs just don't work. Billions of dollars are spent on wasteful training courses, experts say . . . \$5.6 billion to \$16.8 billion is wasted annually on ineffective training programs," and even provides a solution, ". . . experts say businesses should check for results to separate effective programs from costly gimmicks. 'American industry is spending billions and billions on training programs and doing no evaluation of their effectiveness,' says Cary Cherniss, a professor at Rutgers. 'You have to measure it.' "

### **Case Study**

#### **Semiconductor Equipment Operation Training**

The intervention was designed to meet a business need; new hires needed skills training to work in a semiconductor wafer Fab. SortSoft was a new station controller software interface for the Schlumberger 9000 (S9K) tester. The SortSoft Computer Based Training (CBT) package is based on a full, real-time simulator of the SortSoft interface, and therefore was expected to reduce certification time for level 1 Technicians in Sort areas across the company, as well as reducing the trainer time (for technician trainers or engineers/equipment owners) and S9K tester (production) time required for training functions.

The project was unique because it was the company's first full, real-time simulator built to run on a PC and supported by a fully -aligned CBT. In addition, concurrent development was required as the training was to be available to support the implementation of the product at each Fab site. The objectives of the training package accurately reflect the certification checklist from the factories. In fact, the team nearly gained approval for the course completion to stand for certification. The equipment owner engineers (those responsible for the operation, up-time, maintenance, training and certification for the equipment they "own") acknowledged the alignment of the training and felt that the posttest did reflect the actual operations skills required. Although several additional alarm sequences were added to the wafer sorting segment of the posttest, the engineers did not accept it as full certification because they wanted to check for themselves that each operator could demonstrate all the skills on an actual tester.

At the time the team began initial design, a checklist was created covering all the skills required for certification on the SortSoft interface. The checklist was used for updating the skills of technicians certified to

operate the existing interface at the development facility. That checklist was also used as a basis for another recording instrument; equipment owner engineers were asked to carefully track the time it took to re-train the technicians on the new interface and to train new technicians as well. Seven new technicians were trained at the development Fab, and the recorded times for training new technicians were used as a baseline for comparison in measuring the efficiency of the CBT/Simulator training intervention. It is interesting to note that the equipment owner engineers had previously asked to provide training time requirements by the programmer initially assigned to the project and their responses bore no relationship to the actual times tracked during technician training in the development Fab. One engineer reported training times as much as 50% in excess of the actual time required, all other engineers reported training times more than 50% below the actual time required. The instructional designer, aware of the reliability and value of self-reported data, created the time tracking instrument and carefully communicated the purpose and importance of tracking time spent on training. Although the engineers did not match the specificity of time tracking achieved with the CBT/Simulator intervention, the times reported were more accurate and therefore a meaningful basis for comparison.

### **Usability / Functionality Testing**

Basic usability testing, even for paper-based manuals, precedes any performance testing; functionality testing can easily run concurrently with usability testing. Usability means that people can follow the directions, use the documentation or intervention successfully, not get lost or frustrated while trying to use the materials, and not have trouble figuring out what to do next. Functionality testing means the materials work consistently like they are supposed to: the exercises or practice items are aligned to what the trainees are learning to do and anyone who has completed the instruction should be able to complete most or all of them correctly; the answers as well as steps for successful completion are provided as appropriate feedback when required; scenarios or simulations are provided where appropriate to learning outcomes; and the thing works (application runs, links link, manual is accurate and has complete table of contents, index, and sufficient and accurate instructions/directions to users). Once people can get through it successfully, then a tryout or pilot test will provide critical feedback on effectiveness and efficiency of the intervention.

In the SortSoft case, content experts and the test engineers, using an explanatory guideline and checklist created for that purpose, also reviewed the intervention. In some cases, the equipment owner engineers requested that the content be restructured or reorganized in ways that made it more useful for experts (they themselves) but NOT for the novices who made up the target audience, and those changes were refused (with extensive communication about why).

During usability and functionality testing, we identified necessary revisions. We installed a dialog box to pop-up when the trainee selected **Exit** from the application menu, so a trainee could choose to return to the CBT if they did not actually want to exit the CBT. Also, information and content were presented in a different colored text than actual instructions for using the simulator and directions for completing practice items. Some small instructional changes were made to revise confusing practice items or add detail to feedback at the end of several modules. At the request of the equipment owner engineers, two different alarms which routinely occur during typical wafer processing were added in two the final practice scenario and also into the posttest simulation of three wafer lots.

Most surprising of all was the behavior of all the testers in regard to the interactivity level of the training. Trainees were required to complete each module and correctly complete the related scenarios before continuing on to the subsequent module. Directions at the beginning of the CBT and the beginning of each module explained that clearly. However, every single trainee ignored the requirements for interaction and practice, and simply clicked the Next button until they reached the end of the first module; they were then dismayed to see instructions directing them back to the beginning of the module so they could complete the required interaction with the simulator that provided the practice. To address this astonishing outcome, a short module was designed to introduce these trainees to performance-based training. By requiring them to actually complete a brief simulation of the Log In process (no different than logging into their network) prior to beginning the first module, we began to change their expectations about interactive, performance-based training; they all acquired bad habits from completing electronic page-turners (simple presentations) mis-labeled as training.

The CBT development schedule followed the SortSoft development schedule closely, so after additional tryouts at several sites with members of the target audience, and revisions required by software changes or lessons learned in tryouts, the pilot was scheduled at the newest Fab. The entire population of new hires training for Sort Operations (all shifts) reported to a small computer lab for a dedicated shift, and each completed the CBT/Simulator intervention. Trainees worked at their own pace. Trainees could log out to take breaks as each chose; the total time

did not include breaks. Time stamps throughout the program tracked the completion time for each module and each scenario, and all the performance data (answers to questions, selections made when operating the simulator, etc) was also tracked electronically. The completion time varied from 4 hours 10 minutes to 7 hours 50 minutes, with 92% of the trainees finishing in less than 6 hours 30 minutes.

### **Quantitative (performance) Data**

Most quantitative assessments in training involve both skill and knowledge components; these trainees had to know some rules regarding safe and effective operation of the tester itself in addition to knowledge about the operations of the software. The skills section of the posttest utilized the SortSoft simulator, and when the trainee could demonstrate the capability to process three lots of wafers flawlessly while correctly responding to all alarms, the equipment owner engineer conducted the Skills Certification test. The Cert test simply required that the trainee flawlessly sort three lots of wafers while correctly responding to all alarms, although the checklist included the components of that goal in more detail, which enabled engineers to determine areas of failure for those who did not complete the task flawlessly; those components are also part of the SortSoft posttest and performance test.

The standards for the CBT/Simulator intervention were set so as to align to the actual performance goal in the factory. Each equipment owner reported the same results: for the first time in his/her experience, all of the trainees achieved certification on the first attempt, which they described as a huge saving in their time during the most critical time period when a new wafer Fab is ramping up to begin production.

The Level 2 included both the Posttest and subsequent Fab Certification for each trainee:

#### Posttest (two sections):

##### *Knowledge – trainee can:*

- Select SortSoft's purpose / objective, environment and benefits from a list
- Select the correct description and procedures for SortSoft operations
- Label SortSoft's Main Screen and the information displays
- Access / utilize commands in SortSoft's Menus necessary to perform basic SortSoft tasks
- Recognize SortSoft's alarms and state appropriate responses to each

##### *Skills – trainee can:*

- Log in to the tester / SortSoft
- Run a correlation wafer and determine next steps
- Set up the tester for a specified wafer lot and / or probe card
- Introduce a wafer lot
- Modify a wafer lot
- Begin, pause and end testing (with and without saving the data)
- Respond to / resolve typical operations alarms in order to continue or restart testing

As noted, all trainees passed the posttest, and all passed the Certification Test on the first attempt. Initial competency levels, performance consistency, and response to alarms were among the factors listed by our clients when we requested that the equipment owner engineers assess the costs / benefits of the intervention. Two to three shifts (12 hour shifts) were dedicated per trainee for instructor-led training (conducted one-on-one by Technician Trainers or equipment owners), the CBT/Simulator freed up all that time on the part of the Trainer, and all but five or six hours on the part of the trainee, fewer Cert Tests also freed up time for everyone. More importantly, that time was freed up during the most intense times in semiconductor Fab work, the ramping up stage. Equipment owners noted benefits of hands-on training without risking the multi-million dollar \$9K tester or the \$25,000 probe card used to conduct the sorting tests. Down time, even for training, is an expensive proposition because the Fab is so expensive to operate even aside from the capital costs of the testers. Best of all, according to the engineers, the hands-on training did not subject wafers (nearly complete in fabrication when sorted, and therefore very expensive in terms of processing done) to damage and destruction in the hands of novice trainees.

Unfortunately, however, the engineers had developed such a profound distrust of content and applications mis-labeled as training that we were never able to persuade them to allow the simulator-based posttest to qualify as certification for technicians who passed flawlessly. Even the successful re-certifications of 100% of those trained using CBT/Simulator over the next year was not sufficient to overcome the additive experience of so many bad training experiences. Their responsibility as equipment owners includes expensive equipment and supplies as well as expensive product, and although they enthusiastically acknowledged the success of the training and posttest, they wanted to see trainees perform at required levels before they certified technicians to run the equipment without supervision.

## **Qualitative (opinion) Data**

The CBT/Simulator intervention was very different from the typical electronic application provided to the trainees during New Hiring training (page-turners organized by content experts), and the novelty effect likely contributed to the 100% Level 1 response rate. Also, the Level 1 instrument was very specific to the content of the CBT and to the skills required for the posttest and certification, so there was a clear link between the responses trainees gave and the training they had just completed. Several trainees commented that they appreciated the difference between the generic surveys used for other training and one designed to elicit meaningful inputs for the specific training intervention.

## **SortSoft CBT Level 1 Description**

The Level 1 instrument was specifically designed to measure perceptions of motivation, continuing motivation, satisfaction, and confidence. The survey items were specific enough to both content and skill outcomes to enable revisions where necessary. Not all comments resulted in revisions; for example, trainees consistently complained of too many practice items, that they were required to solve more problems than they needed to in order to acquire the skill. However, during tryouts trainees had consistently failed the posttest performance test on the simulator until we increased the number or complexity of the practice problems. Level 1 data has very little value until it is correlated with Level 2 (performance) data; the opinion of the trainee is irrelevant if there is no measurable, observable improvement in job skill – after all, this is on-the-job training in usually competitive businesses, not entertainment. All of the trainees agreed or strongly agreed to the statements on confidence about their performance in the Fab, and that the intervention provided enough information, instruction and practice. All but one trainee would recommend the training to their colleagues and all but one would choose a CBT/Simulator to learn to operate other Fab equipment. The trainee who expressed a preference for instructor-led training was the trainee who took the longest to complete the intervention; language skills (reading comprehension, specifically) were likely a factor in both the completion time and the preference for instructor-led training.

Trainees responded to a list of items using a 4-point Likert-type scale attached to each: Strongly Agree, Agree, Disagree, and Strongly Disagree; after this much time expended on training so critical to the trainee keeping a job, the trainee can reasonably be expected to have an opinion about each statement (an online, 4-point Likert-type scale was implemented with course release).

The Level 1 data was reported out as counts (the number of trainees who agreed with a statement, the number who disagreed strongly with the statement, etc; all four categories for each statement). I specifically coach my clients to pay attention to how practitioners roll up qualitative data, as descriptive statistics cannot be meaningful for this data. The numbers assigned to the categories (typically 1-4 or 1-5) are arbitrary, or artificially determined, so the categories remain Strongly Agree, etc. You cannot take an average of one Agree and one Disagree, and the distance between Agree and Disagree is not numerically equivalent to the distance between Disagree and Strongly Disagree, nor equal to twice the distance between Agree and Strongly Disagree. Reporting out a mean score for opinion data is just meaningless, and it destroys a practitioner's credibility with anyone who has a basic understanding of measurement.

Level 3 (performance on the job) data was captured subsequently when each S9K operator was successfully re-certified to current specifications at appropriate intervals across the next several years. A summative evaluation conducted after three years yielded a request for one module to be deleted due to a change in procedure for processing wafers. Unfortunately, the only other request made at that time was a request to disable the data tracking and writing functionality as no one was using the data even though these trainees all require training in numerous other areas and the data is valuable for learning about that critical target audience who routinely handles and processes wafers so late in the expensive process.

## **Conclusion**

Without using data from the Level 2 and Level 3 evaluations of the SortSoft CBT/Simulator, we could never have achieved the level of performance described above. In the final analysis, we did a better job of training new technicians than the equipment owner engineers; because ISD applied along with expertise in learning and information processing is more powerful than subject matter expertise alone for training. If we had released the intervention in its initial form, the performance levels of new and retrained technicians would have been affected. The company would have paid a huge price when utilizing less efficient training that required far more technician training time over the years, and using less effective training requiring more technician training time adds higher

costs due to more engineer training time and certification time. The costs in damaged equipment and products would be added on also. Overall, it is always cheaper to make the training effective and efficient; instructional technologist time is much cheaper than the long-term costs of bad training for all the trainees who are affected. There are an infinite number of excuses, mostly mythical and all of which result in a lack of accountability for a practitioner. A conglomeration of content, even if carefully formatted, does not constitute training; a batch of information handed out (with or without a PowerPoint presentation) is almost never training in any meaningful sense of the term. In fact, bad training is such a routine occurrence that we had to add a special section teaching trainees to actually complete the interactivity before attempting to continue with the CBT. Good training can even help people become better learners; bad training damages profitability, attitudes, and credibility and causes trainees to develop bad habits.

As professionals, we have a responsibility to deliver what we promise to deliver and what we get paid for. The current rates of change in both technical and non-technical arenas, as well as a slowing economy and tightening budgets contribute to a reality where fewer and fewer people can afford to throw away hours of instruction or training on non-functional conglomerations of content. The consequences of failure are serious; whether the training is for baggage screeners in Boston's Logan airport, or the government employees who help families fill out required forms, or the people who repair combat equipment for Special Forces; the commitment is to ensure learners achieve performance capability. Evaluation is simply not optional for Instructional Technology professionals.

### One Thing To Take Away With You

The most important thing anyone practicing in the performance profession can learn is the power of data if applied as part of the continuous improvement cycle. The following paragraph is used with permission of the authors (available at <http://www.whidbey.com/frodo/isd.htm>) (*emphasis added*):

Perhaps the **greatest strength** of the ISD process is the evolutionary nature of the prescriptive, research-based model itself. While the practice of ISD still retains the strengths of the empirical evaluation and revision cycles, to the extent research and experience permit, it is prescriptive. That is, rather than depending extensively on the test-revision cycle to generate effective instruction in an iterative manner, every attempt is made to incorporate research findings and past experience into the detailed procedures and supporting ISD documentation to ensure that the instruction developed comes as close to the mark as possible the first time. This *improves the validity of the process while also improving reliability*. This has proven to be a *powerful tool* in large scale ISD. In addition, as the process provides more data from the constant evaluation process, the procedures can be continually improved.

### References

- Anderson, J. R. (1995). Cognitive psychology and its implications (Fourth ed.). New York: Freeman & Co.
- Anglin, G.J., Dick, W., Morrison, G., & Richey, R. (2000, February). Reflections on Instructional Technology from some who have been around a few (Ha!) years. Symposium held at the International Convention of the Association for Educational Communications and Technology (AECT), Long Beach, CA.
- Armour, S. (1998). Big lesson: Billions wasted on job-skills training. USA Today, 7 October, 1B.
- Dick, W. & Carey, L. (1985). The systematic design of instruction. Scott, Foresman: Glenview, IL.
- Furnham, A. (1997). Fire the training department. Across the Board, 34(3), 9-10.
- Gagne, R. M. (1989). Studies of learning: 50 years of research. Tallahassee, FL: Learning Systems Institute.
- Gagne, R.M. (1985). The conditions of learning and theory of instruction. Holt, Reinhart and Winston, Chicago.
- Gery, G. (1999). Commentary: Level 2 assessment may eliminate the demand for ROI. followed by S.A. Shrock's response. Performance Improvement, 38(8), 5-6.
- International Board of Standards for Training, Performance and Instruction (IBSTPI). (1998). Standards, Competencies, Ethics. <http://www.ibstpi.org/>.
- Kruger, J. & Dunning, D. (1999). Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. Journal of Personality and Social Psychology, December, 77(6), 1121-1134.
- Merrill, M.D., Drake, L., Lacy, M.J., Pratt, J. & the ID2 Research Group. (1996). Reclaiming instructional design. Educational Technology, 36(5), 5-7.
- National Research Council. (1991). In the mind's eye: Enhancing human performance. Washington, DC: National Academy Press.
- Shrock, S.A. (1999). Level 2 assessment may eliminate the demand for ROI. Performance Improvement, 38(6), 5-7.

- Sullivan, H., & Higgins, N. (1983). Teaching for competence. New York: Columbia University.
- Werner, J.L., & Klein, J.D. (2000). Performance Data in Professional Publications: Signs of Traffic on the Road Less-Traveled. Paper delivered at the Association for Educational Communications and Technology National Convention (Denver).



