

# **2000 Annual Proceedings - Denver: Volume #2**

Selected Papers  
On the Practice of Educational Communications and Technology  
Presented at  
The National Convention of the Association for Educational Communications and  
Technology  
Sponsored by the Research and Theory Division  
Denver, CO  
2000

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Previous Proceedings Published in ERIC

Year	Location	ED Number
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1980	Denver	194061
1981	Philadelphia	207487
1982	Dallas	223191 – 223326
1983	New Orleans	231337
1984	Dallas	243411
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## Preface

For the twenty-third year, the Research and Theory Division of the Association for Educational Communications and Technology (AECT) is sponsoring the publication of these Proceedings. Papers published in this volume were presented at the National AECT Convention in Denver, CO. A limited quantity of these Proceedings were printed and sold. It is also available on microfiche through the Educational Resources Clearinghouse (ERIC) system.

For the first time, these Proceedings are published in two volumes. This volume contains papers primarily dealing with instruction and training issues. Papers dealing primarily with research and development are contained in the companion volume, 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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# COLLABORATIVE DESIGN AND IMPLEMENTATION OF A LARGE UNIVERSITY'S WEB-BASED COURSE

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## Abstract

*This paper discusses issues relating to the design, development, and delivery processes of multimedia modules such as Macromedia Flash®, Shockwave movies®, and Quicktime movies®. These modules were employed to teach an undergraduate plant biology class at a large southwest university. Each medium has different strengths and weaknesses. Their proper use resulted from the collaboration among the content experts, instructional designers, and multimedia developers.*

Equipped with modern web technologies, instructional designers have abundant resources to deliver courses based in a multimedia and rich with interactivity. However, design is only one of several crucial factors of a successful web-based course. No matter how rich the media features are, obstacles during implementation hinder students from effective learning. For example, faculty without experience in multimedia development and distance education may under-estimate the required cost and resources, which may result in a delay of delivery and frustration. In addition, inexperienced Web developers might not realize the diversity of user computers. Web pages look good in a particular platform, a particular browser, and a particular setting might look different in other computers. Further, digital movie is said to be a useful illustration tool, however, lack of appropriate plug-ins and bandwidth may make the media unusable. VanHorn (2000) realized that bandwidth limitation would worsen the digital divide. Unfortunately, Web-based multimedia developers might not be aware of this limitation. In light of these potential obstacles, this paper discusses how a major university designed, developed and delivered a feature-rich web-based course for plant biology. It was found that in this case the design and delivery processes were more problematic than development. Solutions derived from our experience are suggested.

## Course Objectives

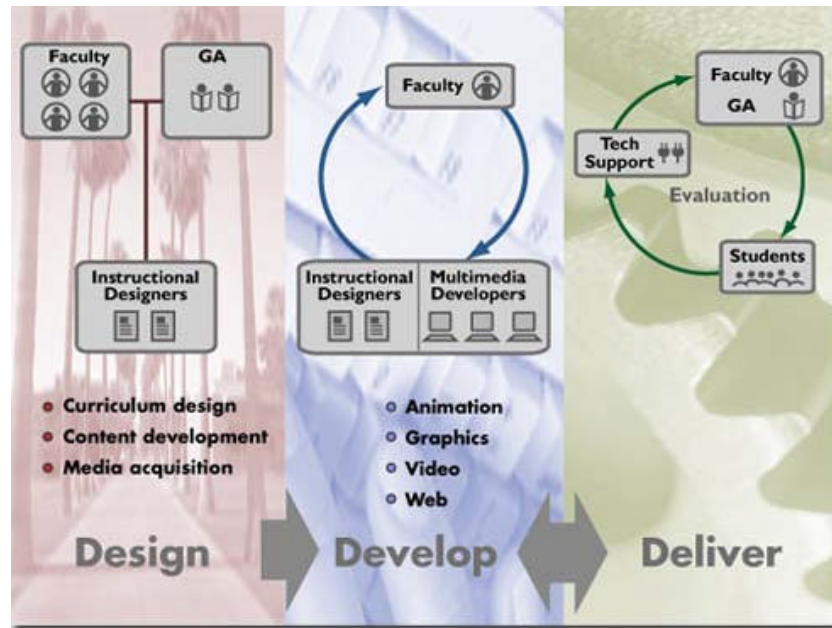
Plant biology 108 fulfills the Natural Science General Studies Course Requirements (S1 & S2). In keeping with the criteria of S1/S2 courses, the following are objectives for Concepts in Plant Biology

1. To provide a substantial introduction to the fundamental behavior of matter and energy as it relates to plants and to the plants' role in the biosphere.
2. To introduce the students to the scientific method and to have them gain experience with application of the scientific method to botanical problems. It is hoped that with such experiences the student will be able to use the concept of the scientific method for solving problems in everyday life.
3. To gain an appreciation and understanding of how plants work so that they may be manipulated to help solve such world problems as hunger, pollution, and global warming.

In order to fulfill the preceding objectives, use of multimedia animation were considered because several concepts in biology are process-based; it is more instructionally beneficial to illustrate those concepts in animation than plain text. The implementation of this multimedia web-based course was divided into three stages: Design, development, and delivery (see Figure 1). In the design stage, the focus centered around curriculum design, content development, and media acquisition. Instructors, including faculty and graduate assistants of plant biology, served as the content experts. Based on their input, instructional designers suggested the appropriate media. In the development stage, a positive feedback loop was established among faculty, instructional designers, and multimedia developers. Since the Web content could not be updated easily, in the delivery stage a formative evaluation scheme was implemented. Students were encouraged to give comments and to report bugs to faculty, graduate assistants, and technical support

personnel. The feedback was re-directed to the instructional designers and multimedia developers for corrections and enhancements of the courseware. Each stage will be discussed in detail in the next section.

Figure 1. Stages of design, development, and delivery.



Allocation of both human and material resources is crucial to the development of a Web-based class. Besides specifying the task involved in each stage, the team also estimated the workload of each group in each stage (see Figure 2). This estimation set a reasonable expectation on each team member to ensure a smooth collaboration.

Figure 2. Resource allocation





## **Design**

PLB108 is a collaborative project between the Biology department and Instruction Support group. Faculty and graduate assistants in the Plant Biology department served as the content experts. Staff in Instruction Support served as instructional designers and multimedia developers (design team). The design team advised and assisted with course design, interface design, and storyboarding. The faculty worked closely with the Instructional designers to take ideas for concepts and convert them into a manner that best utilizes the multimedia delivery system. Based on the input from the content experts, the design team identified three media for serving different purposes, namely, Macromedia Flash (Macromedia, 2000a), Director shockwave (Macromedia, 2000b), and QuickTime (Apple, Inc., 2000). Their capabilities, liabilities, and proper applications are described below:

### **Flash**

Flash can use vector-based graphics and therefore its file size is much smaller. Unlike bitmapped graphics that are composed of pixels, vector-based graphics define the composition of an image by algorithms. A typical animated module made in Flash is as small as 10K.

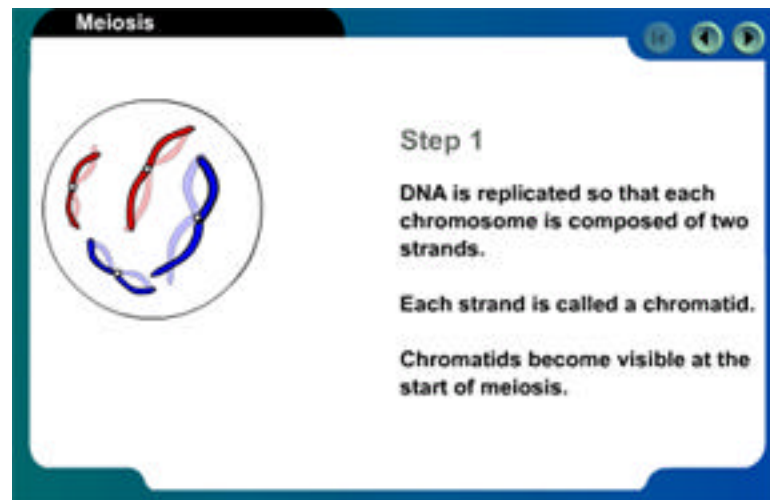
Another advantage of vector graphics is their scalability. Keeping the appearance of a Web page consistent is a challenge to Webmaster because monitor size, resolution, and browser size vary from computer to computer. Vector-based graphics answer this challenge. No matter what the monitor size and the resolution are, vector-based graphics are displayed at a pre-specified percentage, and they will resize themselves according to the browser size.

As mentioned before, consistency and bandwidth limitation are considered major hindrances from course delivery. Vector-based graphics are definitely one of the ideal media for the Web.

However, vector-based graphs carry less information than their bitmapped counterparts. Therefore, they are best-suited for drawing-based images rather than photo-realistic images. It doesn't mean that Flash cannot import pixel-based graphics for photo-realistic illustration, but including bitmapped images will definitely inflate the file size. Moreover, Flash lacks the interactive features and programming capabilities as that of Director.

In the course, Flash is primarily used for modularized presentations. When a complex process is presented, a continuous and linear animation such as QuickTime may cause confusion among learners. An interactive step-animation is designed with the logical break-down of the process. For example, the Meiosis process was broken down into three steps. In each step, the animation is co-presented with descriptive text. The learner has the freedom to replay a particular step of animation (Figure 3).

Figure 3. Meiosis process presented in Flash



This approach is also useful to illustrate complex structure. In the Flash module displaying a flower structure, different components are shown in different steps, but the transition between steps overlay translucent components so that students understand how different parts of a flower are related to each other. In addition, Flash can also be used to associate geographical regions with biomes, which are worldwide groups of similar ecosystems that can be defined by their major vegetation type. In a Flash module, the user can click on several hot spots of a map to zoom in the region and photos of the region will be revealed (see Figure 4). Without an interactive module, the student may find it difficult to go back and forth between a map and photos.

Figure 4. Map of biomes



### Shockwave

Shockwave is made by Macromedia Director, a multimedia authoring system with a powerful programming language, Lingo. Therefore, complicated modules such as highly interactive tutorials are better created in Director. Multimedia modules may involve a time-based process (e.g. growth of a plant, environmental change), a structural relationship (e.g. cell structure), or both. Every multimedia authoring package adopts some type of analogy, which is temporal or/and spatial oriented, to display the

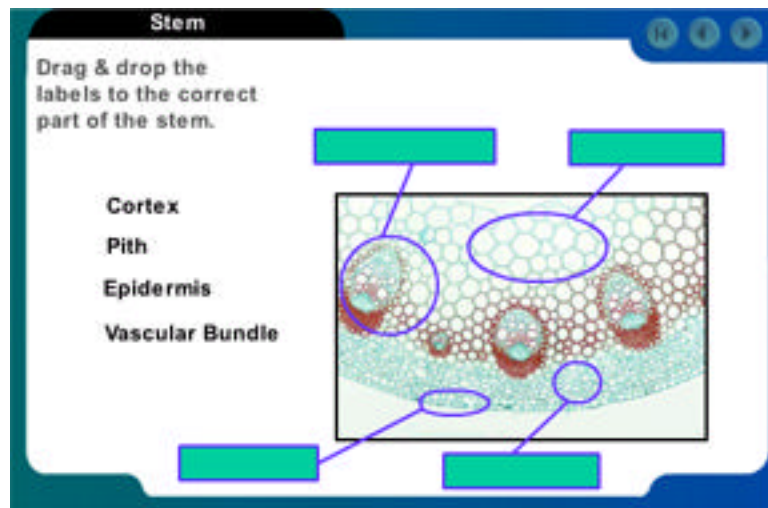
programming environment. For example, HyperCard, HyperStudio (Knowledge Adventure, Inc., 2000), and SuperCard (IncWell, DMG, Inc., 2000), obviously, use a card analogy with an emphasis on spatial structure, in which different layers and objects represent different functions. Authorware (Macromedia, 2000c) uses a flow-chart analogy with a focus on temporal transition, in which icons "flow" along the decision tree. Director uses a movie frame and channel analogy. This programming environment incorporates both temporal (frame) and spatial (channel) dimensions. Therefore, it is considered more powerful than other authoring packages, which use either temporal only or spatial only metaphor. However, since graphics in Director are pixel-based and thus the final product, Shockwave, may be bandwidth-consuming.

In this course, shockwave is used for interactive tutorials that require user interactions. For example, in the illustration of natural selection, users are asked to drag a dark moth and a light moth to a light-colored tree. Later on, the same moths are dragged to a dark tree darkened by pollution. Before the pollution, the light moth is more likely to survive for its protective color in relation to the tree. After the pollution, the survival chances tip toward the dark moth (Figure 5). The objective of this exercise is to let learners see how environment affects natural selection. Although this concept can be illustrated by text, the camouflaging function of moth's color is more dramatic to learners when they actively move the moths from one background to another. This drag-and-drop approach is also used for testing purposes. For example, after students learned the lesson on herbaceous stem anatomy, they were asked to identify the internal organization of a stem by dragging the text into the right position. The exercise has a built-in correcting mechanism. If the student fails to drop the text into the right place, the text will revert to the original position and thus the student has to start it over until all components are correctly identified (see Figure 6).

Figure 5. The Peppered moth presented in Shockwave



Figure 6. Stem anatomy exercise presented in Shockwave



## QuickTime

The strength of QuickTime is its ability to show realistic movies within a low bandwidth because certain third-party software utilities such as Media Cleaner Pro (Terran, Inc., 2000) are able to compress QuickTime files without losing viewable quality. One of the drawbacks is that QuickTime does not have many interactive features. Among the three chosen media, QuickTime is the most bandwidth-intensive.

QuickTime is a proper medium for realistic movies. For example, many biology students may not have a chance to use a high-powered electronic microscope to observe objects at the molecular level such as how a new life is formed through the fertilization of an egg by a sperm, and how the movement of a cell (see Figure 7). This web-based course includes QuickTime movies, which were converted from footage taken from microscopes. In addition, QuickTime can be used for illustrating a time-lapsed process such as the growth of a plant. The purpose of this QuickTime illustration is to explain that each organism has a finite size that it can achieve (see Figure 8).

Figure 7. Movement of a cell showed in QuickTime

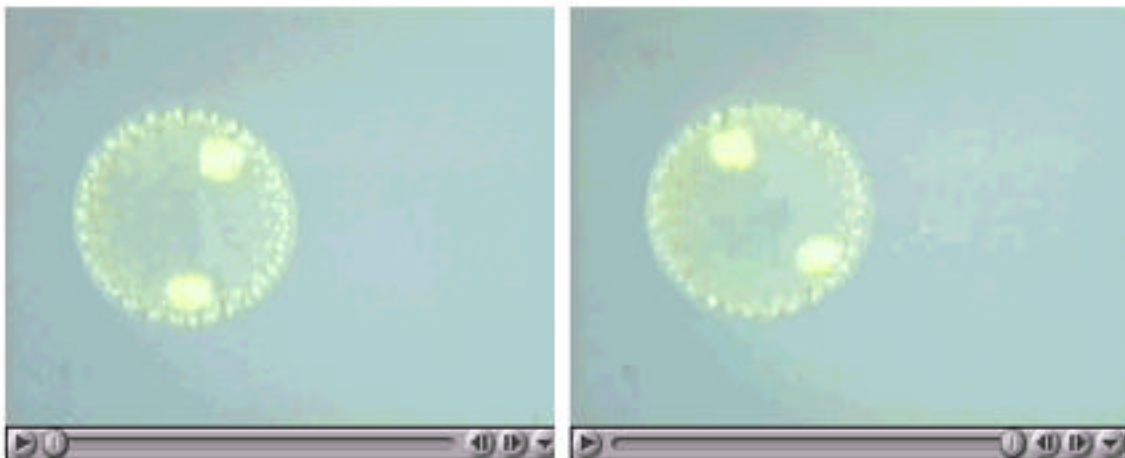


Figure 8. A growth process illustrated in QuickTime



Another use of digital video is the re-creation of historical events. Reading text about history may be dry, however, dramatization of history by actors and actresses gain students' attention. In this class, Mendel and Darwin, prominent figures in biology, come alive in digital video interview.

Software and hardware requirements were imposed on registered students. All the preceding multimedia modules were designed to run on the combination of these specific software and hardware configurations. The minimum requirements are:

- Windows 95/98/NT or Mac OS 7.5
- Multimedia Pentium or PowerPC
- 28.8 modem
- 800X600 resolution, 256 colors (8-bit)
- Netscape 4.0 or Internet Explorer 4.0 or AOL 4.0
- QuickTime Player 3.0
- Shockwave/Flash Player 7.2

The design team was aware that students might not have QuickTime or/and Shockwave/Flash plug-ins. Technical assistance to students will be discussed in the section of delivery.

## **Development**

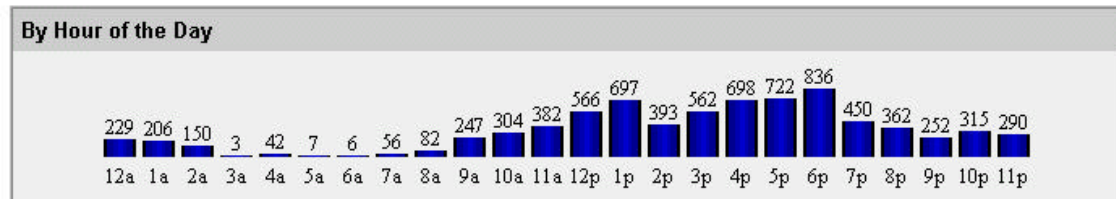
At the development stage, instructional designers worked with multimedia developers to convert the storyboards into multimedia and upload the course to the web. With each release, the faculty proofread the media and provided feedback and changes if necessary. To simulate a realistic learning environment for beta-testing, testers accessed the web content through a dial-up modem and viewed them in a 15-inch monitor. It was found that download time of QuickTime movies was excessive. To counteract this problem, QuickTime movies were burned into a compact disc and offered to students as an alternative. To increase the user-friendliness of the CD, a front end written in MacroMedia Director was inserted so that users could easily navigate across movies. Taking bandwidth into consideration, the development team had decided to convert QuickTime movies to QuickTime streaming and Real streaming movies in the next release. The difference between a digital movie and a digital streaming movie is that the latter can play almost immediately while more signals are being "streamed" to the destination.

The copyright issue was a major concern during the development process. Besides using royalty-free images, the development team created many drawings and diagrams. Approximately half of the development time was spent in creating original artwork for the course.

## Delivery

The course was delivered through Blackboard's CourseInfo, which has built-in features for Web-based courses such as login, quizzes, grade book, chat room, bulletin board, user access tracking, and many others. Students were required to log in, and their movement within the course website could be tracked. Tracking website traffic enables the network administrators and WebMasters to identify the "rush hours" and thus to choose a better time for updating webpages. For example, the user log (see Figure 9) clearly indicates that during lunar hours and in the evening (5-6 p.m.) the server received most hits from users.

Figure 9. Usage of Website by hour of the day



Despite that hardware and software requirements were specified prior to the course, several students were not able to fully access the course materials due to the absence of a proper Web browser and plug-ins. This was anticipated and a technical support team had stood by to provide assistance in upgrading the browser and installing plug-ins. The technical support service was accessible by both email and telephone.

## Summary

Initially, the design process and development process were labor-intensive. It is important to structure the materials during the design process so that later modifications are minimal for future courses. Moreover, when the course is well-structured with rich content and media, based on the input from experienced faculty, a graduate teaching assistant is able to deliver the course seamlessly. As a result, experienced faculty can be released from teaching introductory classes and hence concentrate on research and teaching of upper division courses.

Examples of multimedia resources mentioned in this article are available at <http://is.asu.edu/plb108>. Readers are encouraged to explore the posted modules and give us feedback.

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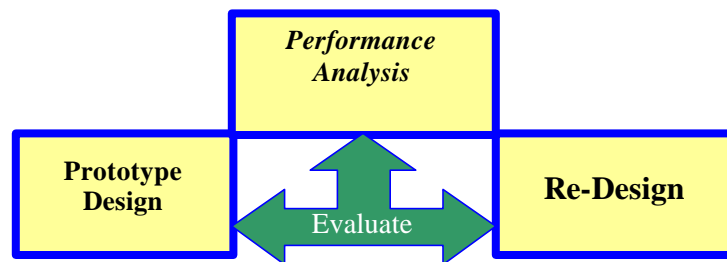
# LEARNING SYSTEM DESIGN CONSIDERATIONS IN CREATING AN ONLINE LEARNING ENVIRONMENT

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## Introduction

This paper describes the design of a web-based learning environment for leadership facilitators in a U.S. military organization. The overall aim of this project was to design a prototype of an online learning environment that supports leadership facilitators' knowledge development in the content area of motivation. This learning environment was designed to provide new learning opportunities for facilitators to build content knowledge through interactive learning activities and experiences with other members of their own community. In order for this learning and performance environment to continually improve and be effective in the long run, issues concerning diffusion of the technology and ongoing learning community development should be addressed.

The iterative design phases used to develop this web-based application are illustrated in Figure 1 below. The processes of analysis, design, and evaluation are often thought of as unique, stand-alone events. This project was managed as a concurrent solution design process incorporating elements of strategic thinking, change creation, work environment design, and rapid prototyping. The front-end analysis and impact evaluation were built into the design process.



*Figure 1. Iterative Design Phases*

The use of this iterative solution design process allowed for increased efficiency and effectiveness in making ongoing refinements and improvements to the prototype. The designers utilized the learning environment design principles identified in the next section to drive the major tasks and to assure project quality.

Additionally, actions considered necessary for ongoing support of the web-based environment were summarized in two major areas: 1) Diffusion of the technology into the facilitator community, and 2) Continuous improvement and adaptation of the site by the community.

## Key learning environment design principles and concepts

The project team agreed upon three broad areas of learning environment design. These components address a wide array of solution analysis, design, development, implementation, evaluation and diffusion issues. For the sake of brevity, these principles have been listed, but not fully elaborated upon, below. These principles are useful as guides to match project needs with learning environment features.



### **Analyzing**

- Identify people who are accountable for the results of learners and engage them in the design goal setting process.
- Identify components and levels of the organizational system where performance-based results are dependent on learning achievement.
- Determine measures of success of learning and performance on an individual and organizational basis.
- Plan how you will evaluate this success (pre-post learning).
- Identify non-training, work environment factors that could contribute to the success or failure of the web-based learning environment.
- Create a plan for diffusion and adaptation of the learning environment within the organization.
- Create an awareness and knowledge of the analysis process.

### **Designing**

- Create learning objectives from performance objectives, based on task, job and/or performance analyses.
- Create activities that gain the learners' attention by engaging them in the learning process.
- Create activities that show learners how the instruction will be of benefit to them.
- Provide ways for the learners to practice learning activities and get feedback on their performance.
- Create ways for learners to assess their own performance in a meaningful way that simulates the actual performance as close as possible.
- Create ways for learners to access a common knowledge base of resources on a given topic.
- Provide ways for learners to interact with instructors and with other learners.
- Provide ways for learners to gain multiple perspectives on a particular problem solving approach.
- Provide a means for learners to access knowledge based on previous learners' experiences.
- Engage members of the learning community or organization in adaptation of the learning environment for better fit within the current culture.

### **Continuously Improving**

- Collect data to measure the success of learners and specific learning environment design processes.
- Identify non-training, work environment factors that could contribute to the success or failure of the web-based learning environment.
- Adapt learning design processes / adapt environment to optimize performance of learners.
- Collect data to measure the success of performers and the organization in meeting goals as related to learning activities and objectives.

These key design principles were used as the foundation for a pre-prototype evaluation plan. The plan included questions derived from a variety of performance improvement theories and models. A solution design decision aid assisted in evaluating the effectiveness of the learning and performance environment. Tables 1 through 5 are excerpts of this decision aid.

<b>Table 1: Strategic Organizational Context (adapted from Ely; Kaufman; Rogers) Evaluation Probes</b>
<b>Strategic Linkages</b>
<ul style="list-style-type: none"> <li>How are project objectives linked to the job, work center, and organizational missions and vision?</li> <li>Has a continuous improvement plan including impact evaluation been completed for this project?</li> </ul>
<b>Innovation-Change Adoption</b>
<ul style="list-style-type: none"> <li>Is there a primary stakeholder, and owner of this project that will support its adoption and diffusion?</li> <li>What are barriers that may prevent long-term or continued success of the project?</li> </ul>

<b>Table 2: Organization-Work Center Context (adapted from Gilbert; Wedman &amp; Graham) Evaluation Probes</b>
<b>Expectations and Feedback</b>
<ul style="list-style-type: none"> <li>Do performers know what is expected of them on the job? Do they know when they have done the job correctly?</li> </ul>
<b>Tools and Information</b>
<ul style="list-style-type: none"> <li>Will supporting documentation, job aids, and other performance support be available?</li> <li>Is there time in the work schedule for performers to use new skills learned in training? (TT)</li> </ul>
<b>Rewards and Incentives</b>
<ul style="list-style-type: none"> <li>Is completion of tasks rewarded or punished?</li> </ul>

<b>Table 3: Performer Context (adapted from Keller; Wedman &amp; Graham) Evaluation Probes</b>
<b>Motivation and Self- Concept</b>
<ul style="list-style-type: none"> <li>Do workers want to do good work?</li> <li>Do they monitor their own performance?</li> </ul>
<b>Performance Capacity</b>
<ul style="list-style-type: none"> <li>Are workers physically able to complete job tasks?</li> <li>What degree of flexibility with respect to work pace, structure, and organization is required of workers?</li> </ul>
<b>Skills and Knowledge</b>
<ul style="list-style-type: none"> <li>Do workers have adequate knowledge and skills to do the job well?</li> <li>Which skills taught in training are not being used on the job? Why aren't they being used? (TT)</li> </ul>

<b>Table 4: Instructional Design (adapted from Dick and Carey; Keller) Evaluation Probes</b>
<b>Practice/Assessment:</b>
<ul style="list-style-type: none"> <li>Does practice seem relevant to on-the-job expectations and performances?</li> <li>Do practice items/assessments match objectives?</li> </ul>
<b>Feedback:</b>
<ul style="list-style-type: none"> <li>Does feedback promote learner satisfaction with the learning experience?</li> <li>Does feedback encourage further exploration? How could exploration be further encouraged?</li> </ul>
<b>Interactivity:</b>
<ul style="list-style-type: none"> <li>If appropriate to objectives, is interaction among learners supported?</li> </ul>

<b>Table 5: User-Computer Interface (adapted from Nielsen) Evaluation Probes</b>
<b>Visibility of system status</b>
▪ Does the learner know where he/she can/should go next?
<b>Match between system and the real world</b>
▪ Does the online learning environment represent or support the work environment?
<b>Consistency and standards</b>
▪ Is there a standard convention used to identify key areas of the site?
<i>Aesthetic and minimalist</i>
▪ Is information presented progressively from more general to more specific, thus allowing learners to drill down to in-depth information as necessary?

To accomplish the objectives of this particular project, the iterative design phases (performance analysis, prototype design, and prototype re-design) were integrated with the design principles to produce a functional prototype. A review of this integration process and recommendations for implementation of the prototype follow.

### **Performance Analysis**

Performance analysis was a process of defining the results expected by the leadership community and the facilitator practices that could lead to achievement of those results. Current and desired facilitator results, practices, and attitudes were analyzed during this phase. Measurable results, critical performance and learning measures, achievable facilitator practices, and work environment factors and conditions that support or hinder performance were profiled. Prototype design began after performance objectives and the flow of information in the leadership facilitator community were identified. The results of analysis were used to guide the planning for the evaluation, design and implementation of the learning and performance environment solution.

### **Prototype Design and Re-design (Continuous Improvement)**

Participatory design processes are effective in building stakeholder and user commitment to the success of application systems through their active participation in the analysis of requirements and the specification of the system design. For this project, each design iteration and improvement was based on discussions with key sponsors, stakeholders and potential users. Participants and designers collaborated to develop a potentially valuable product, identify possible product improvements, and generally provide one another with guidance in the ongoing design of the product.

During this concurrent design and evaluation process, interviews and focus groups were conducted during which visual prototypes clarified concepts that were being discussed. Initial prototypes were PowerPoint slides, which were transformed into a prototype web site using simple WYSIWYG web design tools. To assist in this transformation, members of the target audience provided initial feedback regarding the site look and feel, and overall concept. Following initial feedback, a “joint application design” meeting was held with sponsors (designers, project managers, directors) during which the first relatively primitive web-based site was reviewed live. The purpose of this meeting was to collect data to assist in design decision-making. This review followed a somewhat orderly process with a set of structured interview questions accompanying the review of each screen. A major goal of this design iteration was to ensure that the organizational learning and performance objectives of the site were addressed.

Following this meeting, revisions were made accordingly in order to prepare the site for usability testing / evaluation. The evaluation process included, but was not limited to, assessment of the aesthetic

quality of the interface, and following redesign, assessment of the content, learning activities, and achievement of objectives.

The first level of evaluation was with facilitators at a large training unit with more than 100 facilitators. Upon familiarizing the facilitators with the basic goals of the site, they were provided the URL and asked to provide feedback (we have been requested to not release the results of these evaluation processes by the client).

Following this process, the evaluation processes listed below were also completed:

- Learner/Performer Evaluation - A survey was placed on the website to gather input from facilitators regarding their reactions to site content and learning activities, and suggestions for improvement. Users also had the opportunity to provide feedback on the site discussion board.
- Individual interviews with novice users were conducted to observe a typical user interaction and resolve any barriers to navigation and learning. The user went through each activity and made suggestions for the content and layout of the site.

Specific strategies and recommendations related to utilization and ongoing support of the prototype that was designed and delivered to the client were proposed. These strategies and recommendations were focused in two key areas: 1) Adopting and diffusing the product within the target organization; and 2) Continuously improving the design and usefulness of the current prototype once it has been adopted by the target organization.

### **Adopting and Diffusing the Product: Implementation Strategies**

The most well designed products often go unused or unappreciated within organizations often due to the lack of sponsorship and inadequate attention to the diffusion of the new technology. During the performance analysis phase of this project, many non-training, work environment factors that could contribute to the success or failure of the web-based learning environment were identified. Critical diffusion and work environment factors are identified below to highlight some of the biggest challenges to project success with this particular target audience. Recommendations relative to these factors have also been included.

### **Redefining/Restructuring, and Clarifying Relationships/Roles**

These two critical stages in the diffusion of a technology within an organization have been documented by researchers in many different organizational settings (Rogers, 1995). Following initial design, development and evaluation of the web-based learning environment, it was expected that members of the facilitator community will begin the process of redefining/restructuring and clarifying roles related to this technology. Also see *Communities of Practice* by Wenger (1998).

The following recommendations were put forth in an effort to assist in the initial adoption, and redefining/clarifying of the prototype. Long-term evaluation of the site is possible only after adoption and utilization of the prototype by members of the facilitator community.

Recommendations:

- Identify decision-makers that will advocate the site. This is the identification of key stakeholders within the facilitator community who take responsibility for the product. The project sponsor and individual training units will be responsible for identifying key adopters, change agents, and problem-solvers who will champion the use of this innovation by members of the facilitator community. These role players will be active participants in the design, re-design, and evaluation of the application.

- Identify implementation managers who will diffuse the site throughout the facilitator community. This is a critical aspect of the early design and development of any new product. These are early adopters that must assume the burden of “selling” the product to others, as well as taking on much of the responsibility for its success. One strategy that stakeholders may use is to integrate this tool with other performance support tools currently in use.
- Introduce the site during ongoing activities already existing in the environment.
  - Introduce the site during initial mentoring.
  - Have trainers and mentors introduce the site as a tool for individual and job development. The site could help experienced facilitators mentor and coach less experienced facilitators. Facilitators may be positively influenced to use the site if it is encouraged by their mentors as a useful way to develop skills and build new knowledge.
  - Introduce the site as part of facilitator training. Introducing the site as a tool that can be used by facilitators to build knowledge and skills related to job duties and responsibilities will increase its potential impact and overall effectiveness.

### **Resources for ongoing design and development**

Identification of adequate resources, human and financial, to support the maintenance and continued growth of the application is crucial to success. This is an often-neglected aspect of computer-based application development, especially if the technology requires frequent updating. Web-based technologies are easier to update than other technologies and thus represent a potential long term cost savings.

Recommendations:

- Form a team responsible for learning and redefining the website. Although time and monetary requirements are minimal, it will be essential to identify key personnel who will be responsible for supporting ongoing maintenance of the site. It was suggested that internal facilitators who are familiar with the facilitator community and current practices be trained in change and redesign processes. A technical support resource responsible for updating and refining software and hardware will also be required for continual improvement of the site.
- Conduct prototype review groups with potential users and opinion leaders. Continual feedback from the learning community is helpful in redefining and redesigning the site to support and build on current course content.

### **Incentives**

Incentives and reward systems are one of the least understood yet most effective methods of improving performance in the workplace. The benefits of participating in the learning environment include improved performance, self-development, and professional growth.

Recommendations:

- Official “release” time for participation in learning activities, and recognition for participation are highly recommended. The costs of release time can be considerable but the potential benefits of participation, in terms of improved performance, are well worth the cost.
- Facilitators should receive positive consequences and encouragement from their command to use the site as part of their ongoing skill development.

### **Process Management**

Technical and human resource management will be required to ensure consistent, supportive, and performance-oriented system implementation. The interrelationship of this new process with other facilitator processes is part of the role of project leaders.

Recommendations:

- Leaders of this project within the facilitator community must be fully engaged in the process of creating, refining, communicating and using knowledge that is supported by technology.

- Periodic feedback should be elicited from facilitators to continually improve and add areas of interest to facilitators that are actually using the site.

**Equipment** (see *Site Technical Maintenance* section)

Hardware and software, physical information infrastructure, and documentation will be required to support initial and ongoing system development.

Recommendations:

- Current computer hardware and software must meet minimum specifications in order to capitalize on emerging technologies. This is probably the most expensive (monetarily) of all implementation factors, but can pay off in learning and performance effectiveness in the long term.

**Continuous Improvement of the Learning and Performance Environment**

The following section lists the major components of the web-mediated learning and performance environment. These components address the learning objectives required to achieve selected facilitator performance requirements or best practices. By addressing the best practices that were identified through the performance analysis, this learning environment has a greater likelihood of having a positive impact on facilitator, performer, and organization readiness. The pages that follow offer a brief description of each component of the learning and performance environment, and recommendations for continuous improvement and maintenance of each component on the website. Many of the recommendations included here were generated during the participatory design processes.

**Learning Environment Component: Practice**

*Purpose:* To enhance content knowledge and problem solving ability in the area of motivation through a variety of Self-Assessment/ Content Mastery activities.

These activities include multiple choice, matching and “essay”/case study response formats in an effort to enhance situational problem- solving ability.

Recommendations for Ongoing Development:

- Monitor and update self-assessment items to reflect current course content.
- Continually develop new items that challenge users and reflect current research and practice in the area of motivation.
- Ensure relevant, corrective feedback for each item.
- Add tutorials that provide a review of classroom material for each level of the course guides for motivation.
- Identify current problems to which facilitators can apply basic problem solving skills to solve larger issues/concerns.
- Monitor case study submissions to ensure learning opportunities go beyond that presented in the classroom.
- Continually add new case studies. 'Expert' facilitators could be identified to update and maintain relevant case studies.
- Review submissions by peers and revise as necessary.
- Revise case studies as field experiences change or as current case studies become outdated.
- Hold expert forums in the chat room and/ or archive interview transcripts.

### **Learning Environment Component: Discussion Board**

*Purpose:* To provide current learners with a platform to build usable knowledge for current and future facilitators and leaders through interaction.

Features include: Message Board with chat feature to share ideas, experiences, discussions, etc., and Synchronous and Asynchronous communication options.

Recommendations for Ongoing Development:

#### *Cleaning up/Monitoring*

- Continually monitor information for accuracy.
- Delete outdated or incorrect information.
- Review other discussion boards that may better suit user requirements (see *Site Technical Maintenance* section).

#### *Maintaining Interactions*

- Periodically post new discussion topics.
- Encourage participation by “graduates” now on the job.
- Provide positive consequences for facilitators to interact with others on the discussion board.
- Reward expert facilitators or SME's who participate in scheduled discussions.

### **Learning Environment Component: Help**

*Purpose:* To provide assistance and reduce frustration in navigating through the site. Features include a Site Map, Technical Help with FAQ's and site tips.

Recommendations for Ongoing Development:

#### *Updating/Revising*

- As facilitators become more familiar with the site, Help section will require frequent review/revision.
- Monitor and delete/update FAQ's. Facilitators should be encouraged to ask questions of their peers and to respond to questions appropriately.
- Revise site map/navigational tips based on revisions and advancements to the site.

### **Learning Environment Component: Knowledge Base**

*Purpose:* Where all other features converge to allow for storage of objective (known facts, theories, procedures) knowledge and to promote constructed (new) knowledge.

Features include: Library with motivation-related readings, instructional resources, and links to other organization web sites.

Recommendations for Ongoing Development:

- *Monitor and update/ delete “dead links” to remain current. Many online resources are deleted by the site authors after a certain period of time and therefore many links may become “dead” links.*
- *Links should reflect current course content and should not present views conflicting with current curriculum.*
- *Expert contributions should be archived and continuously updated.*
- *Archived models/theories should be created and easily accessed.*
- *A drop-down menu can be created so that reactions to information found in web links can be accessed under each link in the Library.*

### **Learning Environment Component: Evaluation**

*Purpose:* To provide an opportunity for the user to aid in the continual development of the site.

Users complete a profile that identifies them by location and level experience, among other factors, and solicits their feedback on the site. This profile is also suitable as a Level One (Kirkpatrick) reaction evaluation tool.

Recommendations for Ongoing Development:

- *Evaluation responses should be logged and continuously monitored to assist in usefulness of data in continuous site improvement.*
- *Survey questions (as well as the profile) should be reviewed based on changes to the site and evaluation data expected.*
- *As updates are made to the site, face-to-face evaluations should be conducted in order to observe interactions and to receive feedback from facilitators regarding ease of navigation and usefulness of activities.*

### **Site Technical Maintenance**

The following is a brief description of the tools and applications used in the development of this project. The designers provided sufficient information for an Information Technologist to understand the basic architecture and technical features of this product for the purpose of continual technical development. Where applicable, possible alternative applications to the ones used in the prototype design were suggested.

*Platform:* Windows NT 4 running on Novell Network Server.

- *Maintenance Suggestions:* All site HTML and graphic files should be transferred to a Navy server for ease and control of ongoing site maintenance.

*Web Interface:* The site is optimized to run on MS Internet Explorer and/or Netscape Navigator browsers.

*Development Applications:*

Microsoft FrontPage 2000™

Macromedia Fireworks 3™

Hypertext Markup Language (HTML)

Macromedia Flash 4™

Notepad

Microsoft Access 2000™

Adobe Photoshop 5.5™

Visual Basic Scripting™

Web Crossing™

There are various online course development software applications that have also gained popularity. WebCT, Blackboard CourseInfo, Phoenix Pathlore, and Construe are just a few examples. Alternatively, this site was created with a variety of COTS products that allowed design flexibility for ultimate user customization.



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# **NEEDS ASSESSMENT FOR DESIGN AND DELIVERY OF SITE-BASED TECHNOLOGY-SUPPORTED SCHOOL IMPROVEMENT DEGREE PROGRAMS**

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## **Introduction**

With schools' increasing accountability for student achievement comes increasing pressure on teachers and administrators to know how to effect the needed changes. This paper describes the needs assessment activities that informed the design and development of M.Ed. and post-master's degree courses and programs to be delivered onsite and through distance technology support in rural areas. Two partner school systems participated in the needs assessment with three more currently involved in the programs. Participating school systems range in size from less than 1000 K-12 enrollment to just over 3000. The University partner in this project is Valdosta State University, a regional university in South Georgia with an enrollment just under 10,000. VSU has a large teacher education program, enrolling over 3000 undergraduate and graduate students and providing training for a significant percentage of the educators in the largely rural, economically limited 41 county area covering 1/3 of the geographic area of Georgia.

In spring 2000 nearly 200 teachers and administrators enrolled in a needs assessment course offered by the Department of Curriculum and Instructional Technology. Some of these educators were already involved in systematic school improvement processes at their schools, others were not. They enrolled in the course with the expectation that full site-based graduate programs were in the design and development phase and would incorporate the needs assessment course as a part of the eventual program of study. In essence, students began the program on a promise that the University would deliver the goods. What those goods would be was to be based upon the results of needs assessment activities taking place concurrently with the course. Thus, students were in a unique situation of simultaneously studying needs assessment as an academic topic, conducting needs assessment as a part of their own school improvement process and being involved as subjects in a needs assessment conducted by the author.

In fall 2000 the promise was fulfilled. Participants began to earn graduate degrees in the School Improvement Degree Programs by taking innovative courses offered onsite at their rural school systems and through distance technologies. They are enrolled in degree programs designed and developed to specifically improve their own schools and systems, while increasing their own professional knowledge and competence. The programs, courses and modules were designed based on the extensive school-based needs assessment conducted during the spring course. Partnerships among school personnel, teacher educators and instructional designers have led to programs that are inclusive, team building, action-oriented and flexible. Several other school systems in the region have asked for the programs to be phased in during the next two years.

## **Needs assessment methods**

This paper briefly describes the needs assessment methods, procedures and results. Samples and excerpts from the needs assessment instruments are included in order to assist others who are doing similar work. While one direct outcome of the needs assessment was an initiation of a design and development competition for technology-delivered course modules, that process is described only briefly. For more information about the courses, modules and programs contact the author of this paper.

A systematic curricular and instructional needs assessment was conducted at two rural school systems during Spring Semester 2000. The purpose of the needs assessment was to gain guiding programmatic input from all stakeholders. This input was essential in order to identify the educational

courses and programs required to best meet the educational needs of the individuals enrolled in the program and to achieve the educational outcomes of the school systems involved. In addition, the needs assessment process, data and resulting report established the framework for the "charter" degree program proposal submitted to the University System of Georgia Board of Regents.

Phase One of the needs assessment was really a 'wants assessment' (see Phase one: Demographics and wants assessment). Participants (n=165) were first asked what professional development / coursework would be most useful to them personally. They were asked to include the title and content as well as recommendations for delivery method, instructor, and other participants. This survey also asked for name and contact information, number of years as a teacher, number of years in current position, subjects taught, grade levels taught and leadership roles, if any. The results of this survey were compiled, categorized and distributed to the participants. This served as a discussion topic for groups as they examined their personal needs/requests in the context of school improvement needs indicated by the school profiles they were building during the course. The results of this survey indicated a wide variety of professional development 'wants' with teaching/managing multiple ability levels, time management and technology most often mentioned.

Phase Two of the needs assessment consisted of a survey which asked teachers to identify the grade-appropriate knowledge/skills their students lacked at the beginning of the school year (see Phase two: Student readiness). Analysis of these data resulted in a narrative that described the observed skill deficiencies across P-12 educational levels. Reading and math skill deficiencies were observed spanning the entire curriculum. This narrative was shared with the participants and incorporated into their data gathering for the ongoing School Improvement process.

Participants in small within-school groups held peer-led discussions in Phase Three of the needs assessment (see Phase three: Professional development needs based on School Improvement Plan). Groups were asked to generate five content areas appropriate for School Improvement Degree programs with justification based on documented school improvement needs. They included a short description of the content, target audience and specified delivery options from a given list. Results of this survey generated the following broad categories of professional development/ coursework have been identified as needed to support school improvement goals.

### **School Improvement Areas of Need**

- Curriculum Alignment
- Differentiated Instruction (grouping, at-risk, etc.)
- School-Business Partnerships
- Instructional Strategies (teaching strategies, direct instruction, specific programs, etc.)
- Analyzing Test Scores
- Alternative Assessment (portfolios, rubrics, etc.)
- Cultural Diversity
- Reading Strategies
- Writing Strategies
- Math Strategies and Curriculum
- Motivation
- Test Taking Strategies
- Parental Involvement
- Critical Thinking Skills
- Technology Literacy
- Reference Materials
- Legal Issues
- Team Management
- Interaction With Parents
- Time Management
- Classroom Management

Phase Four asked individuals to judge and report competence in 11 general computer skills and 9 computer skills dealing with Internet use (see Phase four: Computer skills/resources checklist). The Checklist also asked participants to report on the type and quality of computing resources available to them at school and at home as well as their learning preferences in regard to technological delivery of instruction. Findings from analysis of the data produced by this checklist indicated that some individuals would need extensive basic computer instruction in order to participate in instruction using significant technological delivery. However, findings also indicated an overall fairly high level of computer skills competence and a very high level of computer access including Internet access. Participants also indicated a great deal of interest in technological delivery of program instruction, with a concurrent need for peer and instructor contact as well.

In Phase Five of the needs assessment activity, focus groups and peer-led discussion groups involved all participants in multiple assessments. Participants were assigned to these focus groups and discussion groups based on the demographic information collected in Phase One. The needs assessment coordinator facilitated three consecutive focus groups (see Phase five: Needs assessment coordinator-led focus groups). The first group consisted of selected counseling, special education, social work, and speech language professionals to discuss the needs for content from their areas of expertise to be shared with the rest of the school. The second focus group brought together reading teachers to generate ideas for extending reading instruction across all courses/levels. A third focus group, composed of teachers at 'transition' grades from elementary to middle and middle to secondary, generated ideas for the improvement of communication between school levels. Three peer-led discussion groups were going on concurrently with the focus groups. The first (see Phase five: Peer discussion group A) guided participants to respond to expert-suggested 'best practices' within content areas, the second resulted in generation of ideas about professional development needs based on career level and years of service (see Phase five: Peer discussion group B), and the third required participants to create a rubric suitable for judging educational computer use and program ideas for moving teachers to higher levels of computer competency (see Phase Five: Peer discussion group C).

## Needs assessment instruments

The following are examples of either entire needs assessment instruments or excerpts from them. In many cases the format of the instrument has been altered to save space in this paper. For more information concerning the administration of these instruments or the analysis of the data collected through their administration, please contact the author of this paper.

### Phase one: Demographics and "wants assessment"

*Recall: A need is a gap between what is and what ought to be.* In order to design the School Improvement program and courses to meet your individual needs and the needs of your school, your input is essential. Tonight and during the next few weeks, I will be asking you to contribute information and ideas about what will make this program work for you.

I've been asked to design a needs assessment that includes all relevant stakeholders in this process. I'll be asking you to complete short surveys; I may ask that some of you participate in focus groups with me; I may request short telephone interviews with some of you. All the work you've been doing in collecting information for your school profile will be used, as will your work on the school mission and vision. I'll also consult with administrators, college faculty and school improvement professionals in other programs. I'll look at the professional literature to see what successful School Improvement degree programs include and how they are structured.

Anyone who would like to discuss this needs assessment or to contribute ideas for the program and courses is welcome to contact me directly at \_\_\_ or e-mail \_\_\_. Your contributions will be taken seriously and be held confidential.

Please complete the short survey below and turn it in to the VSU faculty for return to me. Before you turn it in, please tear this sheet on the dotted line. I'd like for you to have this needs assessment description to keep, as well as the record of my telephone number and e-mail address.

-----  
-----  
Name \_\_\_\_\_ e-mail \_\_\_\_\_  
School \_\_\_\_\_ work \_\_\_\_\_  
phone \_\_\_\_\_  
How many years have you been employed as a teacher? \_\_\_\_\_ How many years at this school? \_\_\_\_\_  
Subject(s) currently taught \_\_\_\_\_

Grade level(s) currently  
taught \_\_\_\_\_

Do you currently or recently act as a team leader, lead teacher or have other similar duties? Briefly explain.  
-----

(On reverse)

Imagine and describe a professional development course/activity designed just for you. Title? Content? Delivery (in class, hands-on, Internet, etc.)? Length? Instructor (generally, who)? Other participants (generally, who?) What need would it serve?

### Phase two: Student readiness

Grade level: \_\_\_\_\_ (If system or multiple grade levels, please indicate)

In a previous survey, some of you indicated that you are faced with challenges in teaching students of multiple abilities in your classes. This survey is intended to ask your observation of areas for which your students may need more and/or different instructional preparation. (If you don't teach self-contained classes, choose any observed student performance). Write about at least three examples of performance discrepancies and give as much detail as possible.

What grade-level-appropriate knowledge/skills did your students lack at the beginning of this school year? Description of content? Description of student performance?

### Phase three: Professional development needs based on School Improvement Plan

This survey should be done in groups of 10-15 with a facilitator leading, organizing, summarizing & recording. Each group should hand in one document that reflects their collaborative work.

- Generate five content areas for coursework appropriate for the School Improvement Degree programs, both M.Ed. and Ed.S. Be sure that you could justify the content based on documented school improvement needs.
- Include a short description of the target audience for this coursework, if not appropriate for all participants.
- Check the delivery method or combination of methods you think would be most effective for the content.
  - \_\_\_ 3 hr. course offered over entire semester
  - \_\_\_ 3 hr. course offered in 1/2 semester
  - \_\_\_ Multiple-session workshop
  - \_\_\_ Single-session workshop
  - \_\_\_ Self-paced module
  - \_\_\_ Peer-Supported study group
  - \_\_\_ Other

### Phase four: Computer skills / resources checklist

The School Improvement Degree Programs Needs Assessment is being conducted to investigate course and module delivery possibilities as well as content needs. There are many ways instructional technology could assist program delivery including use of the WWW, CD-ROMs, video, e-mail and on-site hands-on lab courses. This checklist is to gain information about your current computer skills and the computing resources you have readily available to you. NOTE: No decisions have been made to use technology in delivery; this is exploratory only.

Here is a list of general computer skills that would be useful for success in technology-integrated instruction. Read each item and indicate the response which best describes your current ability.

I can:

- |   |     |    |
|---|-----|----|
| • Start up, reboot, and shut down a computer        | Yes | No |
| • Start and quit a program stored on the hard drive | Yes | No |

• Save and retrieve files to and from a floppy or the hard drive	Yes	No
• Cut/copy text from one source and paste it onto another	Yes	No
• Open and close menus and windows	Yes	No
• Move and resize windows on your desktop	Yes	No
• Navigate a directory structure to find files	Yes	No
• Type at least 40 words a minute	Yes	No
• Create a word processing document	Yes	No
• Print a word processing document	Yes	No
• Use spell and grammar checking to revise my work	Yes	No
• Log onto the Internet	Yes	No
• Retrieve and delete e-mail messages	Yes	No
• Create, send, forward and reply to e-mail messages	Yes	No
• Distinguish between an e-mail address and a web address	Yes	No
• Send group mailings	Yes	No
• Post messages to discussion lists	Yes	No
• Locate and access information using a WWW search engine	Yes	No
• Check the credibility of Internet resources	Yes	No
• Locate and use appropriate computer resources and technologies within a library or media center	Yes	No

This section asks about the computer resources that are available to you at home and at school.

21. Which of the following describes your home computer? (Check as many as apply)

- |   |   |
|---|---|
| <input type="checkbox"/> Do not have home computer          | <input type="checkbox"/> Computer has printer                   |
| <input type="checkbox"/> Computer has modem                 | <input type="checkbox"/> Phone line available to computer       |
| <input type="checkbox"/> Computer has CD ROM Drive          | <input type="checkbox"/> Connected to Internet Service Provider |
| <input type="checkbox"/> Computer has sound card & speakers | <input type="checkbox"/> E-mail account                         |

22. Which of the following describes your classroom computer? (Check as many as apply)

- |   |  |
|---|--|
| <input type="checkbox"/> Do not have classroom computer     | <input type="checkbox"/> Computer has printer                          |
| <input type="checkbox"/> Computer has modem                 | <input type="checkbox"/> Phone line/network line available to computer |
| <input type="checkbox"/> Computer has CD ROM Drive          | <input type="checkbox"/> Connected to Internet Service Provider        |
| <input type="checkbox"/> Computer has sound card & speakers | <input type="checkbox"/> E-mail account                                |

This section asks about your instructional preferences in the area of course or module delivery via computer technologies.

23. When I am asked to use software or technologies that I haven't used before (such as e-mail, VCR):

- I look forward to learning new skills.
- I feel apprehensive, but try anyway.
- I put it off or try to avoid it.

24. If I had to describe my predominant learning style/preference, I would say it is:

- Auditory - I learn best when I can listen to an explanation of a concept.
- Visual - I learn best when I can read the course materials or view graphics and other visuals.
- Tactile - I learn best by "doing".

25. Having face-to-face interaction with my instructors and peers is:

- not particularly important to me.
- somewhat important to me.
- very important to me.

What are your ideas about how technology could be useful in delivery of the School Improvement Degree Programs? What are your concerns?

#### **Phase five: Needs assessment coordinator-led focus groups**

In this activity, held simultaneously with other Phase 5 activities, participants were grouped as described below. The needs assessment coordinator acted as leader and recorder within a 40 minute time period. The following questions provided the framework for the focus groups.

*Focus Group: "Support for You"*

*Participants:* 8-10 selected counseling, special ed, social workers, speech/language, etc. across schools and levels. Groups are homogenous by support function.

*General Questions:*

1. In what content from your area do other school personnel need training?
2. Who needs training?
3. At what level(s)?
4. How can your needs be addressed in a school improvement program?
  - Professional development needs?
  - Restructuring of time, resources
  - New curriculum materials?

*Focus Group: "Reading for All"*

*Participants:* 8-10 selected reading teachers or personnel in reading support areas (media specialists) across schools and levels. Groups are homogenous by function.

*General Questions:*

1. In what content from your area do other school personnel need training?
2. At what level(s)?
3. Who?
4. How can your needs be addressed in a school improvement program?
  - Professional development needs?
  - Restructuring of time, resources
  - New curriculum materials?

*Focus Group: "Transitions"*

*Participants:* 8-10 selected teachers from 5<sup>th</sup>/6<sup>th</sup> grades or 8<sup>th</sup>/9<sup>th</sup> grades. Groups are homogenous by teaching assignment in a grade which transitions from elementary school to middle school or middle school to high school.

*General Questions:*

1. How can your needs be addressed in a school improvement program?
  - Professional development needs?
  - Restructuring of time, resources
  - New curriculum materials?
2. How can communication be improved between teachers at different schools?

#### **Phase five: Peer-led discussion group activity A**

In this activity, held simultaneously with other Phase 5 activities, participants were grouped (maximum of five persons per group) by content interest and grade level responsibilities. Each group was given a list of 'promising practices' in teaching and learning in their areas earlier identified by experts (teacher educators and arts and sciences content faculty). They were asked to select a leader and a recorder, conduct a discussion and construct written evidence of the results of their discussion within a 40-minute time period. The following questions provided the framework for their discussions.

### Needs Assessment Summary: Promising Educational Practices

- What methods/ideas were most familiar to your group members? Give examples of ways group members have used familiar methods/ideas.
- What methods/ideas were least familiar to your group members?
- Which methods/ideas are applicable across educational levels (s)? Which are not, and why?
- How did you rank the attached methods/ideas according to group interest in further study?

### Phase five: Peer-led discussion group activity B

In this activity, held simultaneously with other Phase 5 activities, participants were grouped (maximum of five persons per group) by years of experience in teaching. They were asked to select a leader and a recorder, conduct a discussion and construct written evidence of the results of their discussion within a 40-minute time period. The following questions provided the framework for their discussions.

#### *Newcomer, Mid-Career and Seasoned Veteran?*

- What are some of the professional development activities by group members in the last 2 years?
- What did the group decide were the top three activities and why?
- How might the professional development needs of your career-level category differ from those of other teachers?
- How might the professional development focus of your school/system need to change to facilitate school improvement?

### Phase five: Peer-led discussion group activity C

In this activity, held simultaneously with other Phase 5 activities, participants were grouped (maximum of five persons per group) by convenience. Each group was given the following activity to complete. They were asked to select a leader and a recorder, conduct a discussion and construct written evidence of the results of their discussion within a 40-minute time period.

#### *Build a rubric*

A rubric is a way of describing what performance 'looks like' at various levels of achievement. For example, the following might be a rubric to evaluate the "Performance of Automobile Drivers".

Level 1: Novice	Level 2: Home Town	Level 3: Standard	Level 4: Expert
Has driven a few times accompanied by an instructor. Must be reminded to signal, maintain steady speed, park correctly and yield to traffic. Is worried and uncomfortable about having to drive.	Drives occasionally in familiar locations. Often fails to signal, maintain steady speed, park correctly or yield to traffic. Is uncomfortable driving at night, in rain or fog, or in moderate traffic.	Drives regularly and competently in generally familiar locations both day and night. Seldom fails to signal, maintain steady speed, park correctly or yield to traffic. Is uncomfortable driving in adverse conditions including unfamiliar locales, inclement weather and heavy traffic.	Drives daily with confidence and expertise. Always signals, maintains steady speed, parks correctly and yields to traffic. Can easily adapt to driving in adverse conditions including darkness, unfamiliar locale, inclement weather and heavy traffic.

#### *Your Task*

What you are to do, as a group, is to build a similar rubric to describe levels of expertise in using computers, either in the classroom or for your own personal productivity at school or at home. You may want to discuss computer use as a whole or, even better, choose a more specific topic like Internet use, word-processing, curriculum/technology integration, database use, etc. Once the rubric is built you will use it to look at your own skill levels and generate ideas for professional development.

- Choose your topic.



- Decide on and name your levels of performance.
- Discuss what a teacher 'looks like' at various levels of performance.
- Write the description of the teacher performance at the various levels.
- Discuss where each of you 'fits' within the rubric.
- Mark an "X" on the rubric for the current level of performance for each group member (no names).
- Generate ideas for what kind(s) of courses/modules offered through the School Improvement Degree Programs would be needed to move teachers to higher levels of competency on your rubric.
- Generate ideas for what kind(s) of resources (hardware, software, facilities) would be needed to move teachers to higher levels of competency on your rubric.

Groups build rubric on supplied form and answer the following open-ended questions.

- What kind(s) of courses/modules offered through the School Improvement Degree Programs would be needed to move teachers to higher levels of competency on your rubric?
- What kind(s) of resources (hardware, software, facilities) would be needed to move teachers to higher levels of competency on your rubric?

## Summary

Program and course development for the School Improvement Programs proceeded based on the results of the needs assessment. It was decided that the courses had to be flexible in order to address the documented school improvement needs of the teachers, administrators, resource personnel within the schools and school systems involved. To meet this need for flexibility some courses in the School Improvement Degree Programs were constructed from or include modules of varying lengths. Each program participant selects modules based on relevancy to his/her teaching and the needs of grade level or content teams or groups. In order to assure consistency and quality, modules were developed according to a template. Instructors were encouraged to adapt existing modules on the same topic building knowledge and skills from module to module. Faculty developing modules were given guidance in developing modules within the template, earned a stipend, and were supported in assembling the modules for duplication, storage and delivery. Designer/developers of modules were required to teach the module the first time through and revise based on formative evaluation data. They may or may not be assigned to teach the module at later points in the school improvement program.

The combination of extensive involvement of teachers and administrators in the design of their professional development within the framework of student achievement has powerful potential. Each year school systems in Georgia write consolidated grant applications that are based on and aligned with their school improvement plans and progress indicators. The integration of this process with the School Improvement Degree Programs has broadened participation in the process of gathering and analyzing student achievement data and has increased interest and individual responsibility for the results.

While the results are not in as to whether these School Improvement Degree Programs will have an impact on the bottom line of student achievement at least the right people are now looking for that impact -- the teachers and administrators themselves in partnership with the University.

## **SUPPORT AND TRAINING FOR HIGH-SCHOOL FACULTY WHO WILL TEACH USING THE WEB**

Zane Olina  
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Wilhelmina Savenye  
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### **Session Objectives**

*The purpose of the presentation is for AECT participants to learn:*

5. *About the major barriers that teachers face when trying to incorporate web-supplemented and web-based teaching into the school curriculum;*
- Practical strategies for providing adequate support and training to teaching staff on implementation of web-supplemented and web-based instruction in secondary schools.

### **Background of the Virtual School Project**

Over a six-year period, a team of staff members in a high school in the Phoenix, Arizona, area explored ways to improve student success while simultaneously reducing instructional costs. Technology as a tool for change played a significant role in most of the solutions that were explored. Increasing access to computers and the internet by students both at school and off-campus resulted in a proposal for implementing both web-supplemented and web-based instruction on a school-wide basis.

During the first phase of the project, emphasis was on piloting two classes/teachers. One teacher began to develop web-supplemented instruction for a freshman English class. The other joined the faculty of The Virtual High School, a consortium project administered through the Concord School District in Concord, Massachusetts, that offers web-based, advanced level high-school courses to students from all across the United States. It is envisioned that the second phase of the project will expand to involve all high schools in the district.

From the start of the project it has been clear that technology is simply a tool rather than a replacement for superior instruction. Teachers have been and will be the primary providers of good instruction. Yet, the major missing component in most technology-integration projects in schools has been a lack of adequate teacher training and support (Office of Technology Assessment, 1995; President's Committee of Advisors on Science and Technology, 1997).

### **The Teacher-Support Component**

The focus of the proposed presentation is on teacher support. Based on the preliminary work of the school-district technology personnel, it was decided to conduct a thorough review of approaches and strategies for teacher professional development and support in technology integration. It was envisioned that this study would further inform the decision-making process regarding the implementation of web-based and web-supplemented instruction at the high school and across the district. The investigation was carried out as a class project in an advanced graduate-level instructional-design class. The class project represents the beginning of a district-university collaborative effort. This presentation will describe the major findings of the investigation and offer practical strategies for teacher professional development and support.

## **Needs Assessment and Content Development**

During the teacher-support investigation, data were collected from four main sources. First, a review of relevant print and online resources was carried out. Secondly, the review of theoretical and applied articles was supplemented by analysis of individual case studies of professional-development programs or resources available for teachers on the web.

Interviews were conducted with five teachers at the high school. These teachers were identified by the campus technology coordinator as the core cluster of teachers who had expressed interest in using computers in the classroom. The teachers were asked about their concerns regarding the use of computers in teaching, their training needs and the types of support that they would need for implementing web-based and web-supplemented teaching in the classroom.

Data from five school or district-level technology coordinators and two faculty instructional-support staff members were also collected through interviews or an e-mail questionnaire. The respondents were asked about major barriers that teachers face regarding integration of computers, training needs and best practices for providing professional development opportunities, support, and incentive systems to teachers.

## **Findings**

*A brief summary of the main findings is presented below.*

### **Major Barriers to Technology Integration**

The most common barriers to technology integration in teaching are the increased preparation time, a lack of awareness of the general benefits of distance education, faculty compensation and incentives, access to appropriate technologies, a lack of shared vision for distance education in organization, institutional barriers and lack of support staff to help course development (Berge & Muilenburg, 2000; Moore & Kearsley, 1996; Office of Technology Assessment, 1995).

According to both the literature sources cited above and the accounts of the teachers and technology coordinators, the lack of time appears to be the single major factor hindering technology integration. Robinson (1995) suggests that development of information technology in education can be seen as part of the broader field of educational change in which there is a rich and useful literature (Fullan, 1993). Thus technology-integration efforts should be addressed as part of systematic efforts at improving *classroom practice*.

### **Teacher Training Needs**

The University of Illinois Faculty Seminar Report (1999) highlights two distinct features of online pedagogy. First, the teaching paradigm must change from the traditional lecture format to one more suitable for online instruction. Secondly, the instructor has an important role in moderating the interaction. Porter (1997) suggests that only educators possessing certain qualities can be successful distance-learning instructors. Such qualities include the ability to learn new technology, a performance personality, flexibility, and time to create new materials and methods.

### **Training Models**

Teacher training should focus on the use of technology in teaching rather than acquisition of skills using software (OTA, 1995; The President's Committee of Advisors on Science and Technology, 1997). No single approach is best for effective teacher professional development (OTA, 1995) and a variety of approaches should be used in combination at any given time. Some common strategies are developing technology rich classrooms as demonstration sites, training master teachers who then serve as resources to their colleagues and providing access to technical support staff.

## **Support Systems**

Support systems should primarily address the major barriers to technology integration mentioned above. Unless a systemic approach to technology integration is adopted individual teacher training initiatives are likely to be ineffective. Providing time for experimenting with new technologies, and the support and incentives for doing so, are some of the most effective strategies. The report prepared by University of Illinois (1999) emphasizes the need for recognizing faculty intellectual property rights as the best way of assuring high quality of online teaching.

## **Implications for Teacher Professional Development and Support**

The literature review, the interviews with the teachers, and the conversations with the technology coordinators have demonstrated that in order for technology integration to take place a comprehensive and systemic approach is necessary. A number of practical suggestions for implementing teacher training and support for web-based and web-supplemented teaching follow. The suggestions are presented in three broad categories: setting the stage, training strategies and support systems for sustaining change.

### **Setting the Stage**

#### **Set a Clear Vision**

Have a clear vision of what your priorities are at the school or district level. Then examine ways in which technology can help you accomplish those broader goals. Unless teachers see the link between improving quality of teaching and learning and use of technologies in the classroom any technology integration efforts are most likely to fail.

#### **Start in Small Steps That Ensure Success**

Start in small steps by encouraging teachers to initially put their syllabus and class assignments on the web, or to create brief online quizzes, or begin using electronic grade books. Then provide them with a bigger picture of what the next steps in progression might be.

#### **Evaluate Progress Against Initial Goals**

Monitor the progress and measure the success of technology integration based on the initial goals. Technology integration is not about the number of computers in each classroom or about the number of internet connections it is about a better quality of teaching and learning.

#### **Involve Faculty in Decision Making**

Involve faculty in formulating the vision and setting priorities for your school as much as possible. Hiring external instructional designers and web developers may seem to be a quicker and more efficient short-term solution. Yet, this approach does not empower teachers to try out un-conventional instructional strategies or to model effective technology use to their students.

#### **Establish External Partnerships**

Establish external partnerships with local universities and businesses for additional expertise and support. For example, graduate students from universities can provide instructional design expertise to teachers for course development. Businesses can let teachers attend their training events or provide volunteers to coach teachers on technology skills.

#### **Allocate Adequate Resources for Professional Development**

US Office of Technology Assessment recommends that at least 30% of technology funds be spent on training. Provide teachers with release time for jump-starting new web-based courses, or stipends for attending training workshops. Compensate teachers instructing their colleagues on technology skills for planning time and training that they provide after school hours.

#### **Provide a Common Set of Course Development and Delivery Tools**

Consider adopting a commonly used courseware package such as Web CT, CourseInfo or others for the entire school or district. Provide training and technical support for the users. A common courseware

package provides students with the same interface for all the courses offered and they are not distracted from core learning tasks having to master a variety of applications. A common set of tools requires fewer resources for training, support and management of web-based instruction.

#### **Provide Adequate Infrastructure and Technical Support**

Ensure that teachers have access to the necessary hardware and software tools for developing and implementing web-based and web-supplemented instruction. One of the models that has proven itself successful has been providing the teacher with a laptop and equipping the classroom with a minimum of five workstations with internet connection. In addition, in order for web-based and web-supplemented instruction to be successful students also need to have access to computers and internet outside the regular school hours. A high-speed server for hosting web-based course materials is also an absolute necessity once web –supplemented and web-based instruction becomes more widely spread at the school.

#### **Training Approaches**

##### **Pick Your Trainees Carefully**

Web-based instruction requires considerable investment in training and daily coaching. Select your trainees carefully, especially at the initial stages of adopting web-based instruction at your school. For the trainees to be successful and to serve as role models for their colleagues they should meet a number of criteria. The trainees should be:

- Open-minded and willing to continually learn new technologies and teaching approaches;
- Experienced teachers who are familiar with a range of teaching strategies in face to face situations so that they have a pool of ideas to pull from for web-based instruction;
- Familiar with the course content to be delivered entirely or partially over the web;
- Comfortable with technology;
- Capable of collaborating with others;
- Willing to share their experiences and expertise with their colleagues.

##### **Use a Variety of Training Approaches**

Provide a wide selection of training opportunities to satisfy the varied training needs of the teachers. Those already familiar with technology will need only additional encouragement and ideas for classroom applications of technology that can be provided over the web. Novice learners will need very specific initial training aiming at teaching very specific technology skills and their applications for the classroom and ample opportunities to practice these skills.

##### **Provide Follow-up Support**

Avoid stand-alone training events whenever possible. Instead, offer a series of training events enabling teachers to come back with questions and to try out the newly learned skills in practice. Provide follow-up support at the school or district level by making the trainer accessible at least a few times a month or by encouraging the participants to form local support groups.

##### **Focus on Classroom Application of Technologies**

Focus all training on the classroom applications of technology rather than mastering specific software programs. Emphasis on the application of internet or software programs in the classroom will provide context for the training and will help teachers apply the newly learned skills in practice.

##### **Provide Plenty of Real-Life Examples**

Provide teachers with a range of real-life examples and case studies of successful technology integration initiatives. Whenever possible, the examples should offer solutions to the challenges and concerns that teachers face in the classroom on a daily basis, such as lack of student motivation, varied ability and interest levels of a diverse student population, lack of time to provide immediate feedback on student assignments and others.

### Model Technology Use

Model technology use during training by choosing the most appropriate delivery medium. If you are training teachers on web-based teaching then at least part of the training should be delivered over the world wide web.

### Provide First Hand Experiences With Technologies

Best of all if teachers have the opportunity to participate in web-based training themselves in order to step into the students' shoes. If that is not possible provide as much hands-on experiences with web-based and web-supplemented instruction during your training as possible.

### Just in Time Training Works Best

Timing of the training is important. Target the training primarily at those who will need to deliver web-supplemented or web-based teaching in the very near future. Best of all, design the training around the actual course projects that the teachers will be implementing to ensure direct application of the newly learned skills in practice.

### Allow for Plenty of Time

Learning takes time and opportunities for trial and error. Allow trainees time to try out smaller assignments and be successful before launching into larger semester-long course design projects. Research shows that on average it takes around three to five years for teachers to become comfortable with technology.

### Do Not Have the Same Expectations for Everyone

Do not expect every faculty member to integrate technology into his or her teaching to the same extent. Each teacher has his or her own set of values and instructional approaches to make him or her most effective in the classroom. Web-based instruction requires a major change in one's teaching and learning approach and the medium might not suit everyone.

## **Support Systems for Sustaining Change**

### Provide Ongoing Technical Support for Teachers and Students

Once web-supplemented and web-based courses are offered at a relatively large scale at the school or at the district both teachers and students must have access to a technology help desk by phone twenty-four hours a day. In addition to campus technology coordinators, school librarians or media specialists could be trained to provide necessary technical support. Librarians could also provide instructional support to teachers by locating useful web sites for instruction or coaching students on internet search skills or online study strategies.

### Use Students in Faculty Support Roles

Ask motivated high school students with technology skills to assist faculty in putting their courses on the web. Students could undertake these tasks as independent study projects or as part of their school to work experiences.

### Provide Opportunities for Sharing of Ideas and Information

Set up a curriculum and technology resource center at the district level where teachers could access to additional computers, software and information and advice regarding web-based instruction. Set up and maintain a support web site for teachers where they could access online tutorials, share lesson plans and plan collaborative course projects.

### Consider Adequate Recognition and Rewards

Recognize teachers who excel in web-based and web-supplemented teaching as instructional innovators. Recognition in front of peers is one of the most effective means for rewarding an accomplished teacher.

#### Develop and Implement a Clear Intellectual Property Rights Policy

Develop and implement a clear intellectual property rights policy at the school or district level. Teachers should never feel that by developing online courses they will some day lose their jobs or that someone else will teach their courses. Before developing new online materials an agreement should be signed between the author and the school or the district as to who will own the materials once it is published online and how the materials will be used. The developer should always be asked for permission when his or her materials are to be used for other courses.

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# **EXAMINING THE IMPACT A MEDIA DISTRIBUTION SYSTEM HAS ON A HIGH SCHOOL CLASSROOM ENVIRONMENT: A CASE STUDY**

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## **The Study**

The site for this study was the west suburban Chicago metropolitan area. The school district was a unit district providing classes for students in grades K-12. There were 14 schools in the district with a new elementary school and new high school under construction at the time of this study. The high school, where this research actually took place, had an enrollment of approximately 3200 freshman to senior students.

For this study, 28 participants were interviewed. Of these participants, 13 were teachers, 11 were students, and 4 were adult support personnel, which included a library/media specialist, an assistant principal, a library assistant, and a computer technician. Survey data were also collected from 40 teachers who had access to the media distribution system. Teachers reported on how often they used the system, what devices they used, and responded to evaluative statements on using the system.

The transcripts of the interviews were imported into a qualitative data analysis computer program. Interviews were then coded into 18 categories for retrieval and analysis. The information that emerged from the interviews and survey was divided into two areas, (a) the positive impact on the classroom and (b) the areas of concern that participants had about using the system.

## **Positive Impact**

Based on the survey and interview data, the following summarizes what students and staff reported:

1. Classes didn't have to worry about sending and receiving carts of audio-visual equipment to and from classrooms. The ability to access the media distribution system was immediate.
2. The system was easy to use from a staff and a student perspective.
3. Class time was interrupted less by scrolling the daily announcements over the system rather than someone reading announcements over the PA system.
4. It allowed class instruction to be more spontaneous. The "teachable moment" didn't have to get away, the class now had immediate access to a variety of multimedia tools.
5. Teaching styles became more hands-off while student participation styles became more hands-on.
6. Cable TV allowed classes to view world events and late breaking news as it was happening.
7. The media distribution system helped address the learning styles of visual learners. Teachers were able to present material in a variety of ways.
8. A classroom with a media distribution system was more efficient than a traditional classroom.

9. Classes were more judicious in their use of video. Students were more likely to view snippets of video when they had access to a media distribution system.
10. The ability to network classrooms, to view media in multiple classrooms at the same time, was beneficial.
11. Teachers reported the positive effects for students using the system that included the following:
  - Students found it easier to present electronically. Students were able to move from posterboard speeches/presentations to multimedia presentations.
  - Using the system placed the attention of the class on the information and not the student.
  - Using the system allowed students to follow their interests in preparing for presentations.

Survey statements number 1 and 16 related to the overall impact on the classroom environment. In statement one, 23 participants (72%) agreed that they were very happy with the media distribution system and its capabilities. And in statement number 16, 24 participants (77%) said that the overall impact of the system on the classroom environment had been positive.

Finally, the teachers' comments say much about using a media distribution system. For example, teacher number nine stated that "it has changed teaching and learning in our class." Teacher number two voiced, "It makes you a better teacher, it makes your class a better classroom." And, teacher number seven stated:

To me I guess it's kind of a continual development. It's evolved from the television on a cart thing, to this. What the next step is, I'm not sure. But the point is that this is a definite improvement over where we were.

### **Areas of Concern**

Based on the survey and interview data, the following summarizes what students and staff reported:

1. Having to give up the control of loading the videotapes into the VCR was an issue expressed by both teachers and students. Participants did not like the fact that the VCR was not in the classroom and they gave up this control to the people in the Resource Center.
2. Teachers said that the 27-inch monitor size was too small. No student reported having a problem with the monitor size.
3. Sixty-two percent of the teachers surveyed said they don't really need all of the bells and whistles included in a media distribution system. They just need a TV/VCR in their room and it would take care of most of their media needs.
4. There was a strong perception that the media distribution system is just for showing videotapes. Comments like, "Wouldn't it be cheaper to have TVs and VCRs in each classroom?" reaffirms this perception.
5. Only 12 teachers (41%) thought the inservice training they had received on the media distribution system was appropriate for them to use the system.
6. Teachers were interested in additional training, 19 teachers (59%) reported they were interested in more inservice training on the media distribution system.
7. There are some issues in running and maintaining a media distribution system including:

- Sensors can come loose.
  - There is no battery indicator in the remote to know when they need replacing.
  - Human error in scheduling or loading the system.
  - CCM box at the top of the monitor can be disconnected.
  - Students “play” with the buttons on the front of the TV.
8. The wireless keyboard used to access the computer at the head end was very cumbersome to use.
  9. There is a cost of maintaining the media distribution system when the school personnel are unable to fix hardware or software problems. An outside company needs to come in to complete repairs.

### **When Buying**

Based on the results of this study, there are several important points that a school should consider before purchasing a media distribution system. These would include the following:

- Plan to have a computer connected to each classroom monitor. A media distribution system is a presentation system for both students and teachers. A computer will enhance the potential of the system by: (a) giving the teacher the ability to schedule media from the classroom and (b) the ability to show computer images to the class. Purchase the computer with a TV card. This will allow the user to connect to the TV with just an RCA cable.
1. Purchase the largest monitor that is practical for the budget. At the site that this study was conducted, 27-inch monitors were installed. Some of the teachers thought that this size did not provide adequate viewing for the entire room. A larger monitor will provide a larger viewing area for the classroom. A school should also have the option of connecting an LCD projector to the system. An LCD projection system in the classroom will allow for a significantly larger viewing area.
  2. Consider the monitors that accept a computer signal. Traditionally, to show a computer image on a TV screen, a scan converter was needed to convert the computer signal to a signal that the TV monitor could “understand” or show. Some monitors will accept the computer signal and provide much better resolution when showing computer images. Students and teachers will appreciate the better resolution.
  3. Purchase monitors without buttons on the front of it. Or, some monitors let the user internally disable the buttons. This will be less of a distraction for students who want to explore what each button does.
  4. One of the negatives that came out in the study was that teachers did not like the idea of giving up control of the videotapes to the personnel operating the system. A school could consider providing VCRs with some of the monitors, especially if a teacher uses many videotapes during a specific class. The price of VCRs have come down to a point that would make this idea more possible.
  5. Inservicing the teachers is a key to the successful operation of the media distribution system. Although the system is easy to use, the more that teachers know of how to use the system, the greater the potential for teaching and learning. Plan on initial training and also follow-up training once the teachers have acclimated to the system.

### **Written Survey Data**

The following are the teacher responses from the anonymous survey.

This study can be viewed on the World Wide Web at: <http://www.inil.com/users/bobmm/dissuse.htm>

Media Devices Used									
	Daily		Weekly		Monthly		Never		Total Responses
CDI Player-Encyclopedia	0	0%	0	0%	4	13%	28	88%	32
CDI Player- Audio CD's	0	0%	0	0%	5	16%	27	84%	32
AM/FM Tuner	0	0%	3	9%	2	6%	27	84%	32
VCR	2	6%	14	44%	16	50%	0	0%	32
Laser Disc Player	0	0%	1	3%	4	13%	27	84%	32
Still Video Floppy Player	0	0%	2	6%	7	22%	23	72%	32
Computer to Monitor	0	0%	1	3%	5	16%	26	81%	32

Cable Channels									
	Daily		Weekly		Monthly		Never		Total Responses
History Channel	1	3%	0	0%	0	0%	31	97%	32
CBS	1	3%	0	0%	4	13%	27	84%	32
NBC	1	3%	0	0%	5	16%	26	81%	32
WTTW	0	0%	0	0%	6	19%	26	81%	32
WCIU	1	3%	0	0%	1	3%	30	94%	32
CNN	0	0%	2	6%	9	28%	21	66%	32
Weather Channel	0	0%	1	3%	6	19%	25	78%	32
Arts & Entertainment	1	3%	1	3%	1	3%	29	91%	32
CNN Headline News	1	3%	1	3%	6	19%	24	75%	32
Discovery Channel	1	3%	0	0%	3	9%	28	88%	32

Survey Statement Responses									
	SA & A		No Opinion		D & SD		Total Responses		
1) Very happy w/capabilities	23	72%	4	13%	5	16%	32		
2) Inservice appropriate	12	41%	7	24%	10	34%	29		
3) Rather teach in an MDS room	22	69%	8	25%	2	6%	32		
4) 27-inch monitor is large enough	16	52%	1	3%	14	45%	31		
5) Would like more inservice	19	59%	6	19%	7	22%	32		
6) Import. use engage learning	26	87%	4	13%	0	0%	30		
7) MDS helps engage students	22	69%	9	28%	1	3%	32		
8) More efficient w/MDS classroom	19	59%	9	28%	4	13%	32		
9) Prefer just TV/VCR	9	28%	11	34%	12	38%	32		
10) MDS provides rich media environ	21	68%	10	32%	0	0%	31		
11) Believe in rich M/environ	28	88%	3	9%	1	3%	32		
12) Prefer traditional classroom	4	13%	9	29%	18	58%	31		
13) Efficient w/lessons using media	14	44%	9	28%	9	28%	32		
14) Use more media	13	41%	8	25%	11	34%	32		
15) 21st Century classroom	24	75%	6	19%	2	6%	32		
16) Overall impact positive	24	77%	6	19%	1	3%	31		

# DESIGN, DEVELOPMENT AND EVALUATION OF A VIRTUAL HISTOLOGY COURSE

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## Abstract

*This paper describes the design and development of a distance-delivered, upper-level science course, and the results of a study conducted to determine its effectiveness relative to the on-campus section of the same course. This course takes advantage of the unique characteristics of the Internet by using it to transmit visual information and allow for asynchronous and synchronous interactions. The assessment conducted focused on content mastery and the effect of computer-mediated communication on type and depth of questions. No significant differences in academic achievement were observed between the two groups. However, the rate at which students and faculty interacted was much greater in the online sessions (chat and review), and a greater percentage of higher order questions were asked in the online sessions.*

## Introduction

WebCT Inc. recently recognized online Histology as an exemplary course due to its academic rigor and content robustness. This paper will briefly outline the design and development processes involved in creating the course and subsequently focus discussion on the results of a study comparing virtual histology to a traditional (on-campus) section of the same course taught simultaneously by the same instructor.

## Course Design and Development

A needs analysis to determine the feasibility and value of offering an upper level science course via the Internet was conducted by one of the authors (SMC). She discovered a need for upper division science courses offered in an asynchronous format in order to meet the needs of students, mainly those of non-traditional ages and backgrounds, pursuing pre-health majors. Scheduling conflicts made it particularly difficult for students with family and work responsibilities to attend traditional on-campus science lectures and laboratories. Having taught Histology, a study of tissues, for many years in the on-campus environment, she was able to recognize its potential for conversion to online delivery. Given the nature of the subject, the course is image-intensive, making it ideal for Internet delivery. WebCT was selected as the delivery system because of its ability to offer controlled access and rapid downloading of images via its CDROM tool. The goal was to create an online course that would preserve the same objectives as the on-campus course while harnessing the unique properties of the delivery system to allow for other types of instructional activities. The resulting course emphasizes the concepts of histology rather than the development of psychomotor skills relative to physical manipulation of a microscope.

Although at the time of the study all required components (including examinations) were offered asynchronously (participation in chat sessions was optional), in its current form, the online histology course offers asynchronous lectures and laboratories and synchronous examinations and online discussions (chats). An expanded syllabus (a combination of a calendar, traditional syllabus and learning objectives) guides students and permits self-pacing. Lectures are designed to simulate real lectures instead of being a modified textbook. Clinical examples and everyday analogies emphasizing content applications are frequently inserted in the lectures. Students are guided by objectives and a text reading assignment for each lecture. At the end of each lecture, a humorous slide of the instructor leads students to the formative quizzes ("bonehead quizzes"), which provide them with instant feedback about their level of learning. These quizzes are not graded because they are designed to scaffold metacognitive skill development and add some humor to the lectures. Each week at a scheduled time, the students are invited to participate in an online discussion of current course topics. Chat sessions are well received by the students. The instructor leads

these sessions with questions about content. In addition, students are called upon to ask each other specific questions about the material. The result is the creation of a sense of community (there are often humorous asides and social interactions), where members support each other and value individual contributions to a group learning environment. During these sessions, students are confirming their level of knowledge and gaining insights about “how the instructor asks questions.” On their own, students have started setting up additional online discussions each week.

Online Histology addresses a variety of learning outcomes, ranging from simple declarative knowledge to the development of higher-order cognitive skills, such as scientific problem solving. The manner in which the characteristics of the Internet were harnessed to address each type of outcome:

- **Content knowledge:** The distance class was a section of the traditional course. For the sections taught by SMC, both the online and on-campus courses covered the same material, had the same objectives, and had the same examination questions. The only difference between the online and face-to-face sections was the manner in which the material was presented. While most of the face-to-face instruction took the form of a didactic lecture, the bulk of online instruction was presented through visually stimulating web pages containing practical examples that allowed the learners to control the pace of instruction.
- **Problem solving skills:** Online science courses have been criticized for lack of laboratory experiences (Carr, 2000). In the online histology course, this problem has been overcome by the creation of an interactive online laboratory that provides an experience very similar to that of an on-campus histology laboratory. Using the Internet, a series of images captured at various powers of the microscope are sequenced and linked together to simulate the views from a microscope at different powers. The only difference between the online traditional laboratories is that students are not physically manipulating a glass slide and focusing a microscope in the online version of the course. Since these psychomotor outcomes may be of value to students pursuing careers in histology/pathology, an on-campus lab is offered as a supplement. However, the lack of psychomotor learning is more than compensated for by the increased amount of questions discussed in class and the greater depth of thought (and interaction with the content) demonstrated by students in the online class.
- **Metacognitive skills:** Learning science at a distance requires students to acquire higher order cognitive skills and metacognitive skills, such as reflective analysis, independent thought, time management and self-motivation. Frequent e-mail and online chat interactions with the instructor provide support for students while encouraging them to take responsibility for their own learning.

As part of the development process for this course, differences and similarities of online and on-campus environments were considered. There was a conscious attempt to create an inviting but challenging online environment that would parallel the academic rigor expectations of the traditional course. Almost 5,000 images were collected and inserted into the course in order to fully present the content in an interactive environment. Administrative and colleague resistance was encountered throughout the development process. Concerns of academic rigor, “seat time,” appropriate generation of official credits, and how to assess faculty teaching in this medium for purposes of promotion and tenure were and still are encountered frequently in the development and implementation of this course. Finally, the instructor has always enjoyed interacting with students in her on-campus courses, and was concerned the opportunities for this type of contact might be diminished with the online course. The instructor was able to confirm that instructor-student interactions occurred with at least as much frequency in online environments as in the on-campus settings.

## **Course Evaluation**

Recent trends (International Data Corporation, 2000) in distance education make it necessary to explore the effects of online delivery on students’ academic and personal growth. Since an ever-increasing number of courses are being offered at a distance it is important to investigate the quantitative and qualitative effects of an online delivery medium on student outcomes.

The Histology course gave us a unique opportunity to extend the current research on distance education into the realm of advanced science courses—a topic of great concern in the current literature. We were able to investigate the effectiveness of the Internet as a tool to teach science at a distance, as well as

how the medium affected interaction among participants (students and faculty) thanks to the availability of parallel course sections taught by the same instructor.

## **Study Design**

The research questions addressed in the study were:

- Is online delivery as effective as face-to-face instruction for science classes? Specifically, was there any difference in academic outcomes between the sections?
- How does computer-mediated communication affect interactions in an upper-level science class? Specifically, does it affect the number or type (depth) of questions asked?
- If there are any differences in interactions, how do these changes affect learning outcomes?

Participants in this study were students enrolled in either the on-campus or distance section of Histology at Colorado State University. Forty-four students volunteered to take part in the study. Of these students, 33 were enrolled in the on-campus section and 11 took part in the online section. Student participation was observed in three settings: face-to-face lecture (traditional instruction), online class (instructor-led synchronous discussion) and online review (student initiated study session, without instructor's presence).

In order to answer the aforementioned research questions, students in both sections were asked to complete a diagnostic quiz. This quiz provided a baseline measurement of all students' prior knowledge. The academic performance of students in the on-campus section was measured by their performance on relevant sections of a lecture exam (material taught by the participating faculty member). In-class interactions (questions asked) for this group were recorded by direct observation. Students in the online section allowed the researchers to access their exam results electronically. The conferencing software automatically recorded online interactions during chat sessions. In addition, students in the online section completed a course survey addressing their perceptions of this type of instruction.

## **Results**

There was no statistically significant difference ( $p = 0.05$ ) between the experimental and control groups on either the pre- or post-test. However, the amount of interactions (questions asked) varied greatly by setting. During face-to-face lecture sessions, an average of 18 interactions took place per hour. Online class sessions averaged 51 interactions per hour, and online review sessions had an average of 54 interactions per hour. Students assumed a more active role in the online sessions than they did during the face-to-face lectures, despite being specifically asked to participate in the lecture sessions. Students initiated 41% of questions during online classes, but only 34% during face-to-face lectures. When the topic of these questions was examined, it was determined that the questions asked during lecture sessions were almost exclusively focused on content topics (87%), and no social questions were observed in this setting. A student spontaneously assumed the role of facilitator during the review sessions, which led to a comparable amount of management interactions in both online settings (27 – 28%). The main difference between online class and review sessions was the shift of 10% of the interactions from content topics during class sessions to social interactions during the review sessions. An average of 66% of interactions were dedicated to content topics during the online class sessions, but only 56% during online review sessions. A more in-depth examination of the content interactions revealed that a substantial amount of interactions (60%) asked during lecture sessions were of a low cognitive level (levels 1 and 2 of Bloom's Taxonomy – knowledge and comprehension). Both the instructor and students asked a larger proportion of high-level questions (levels 5 and 6 – synthesis and evaluation) during the online class sessions than they did during the face-to-face lecture sessions. The vast majority of interactions in review sessions were at the lower levels of Bloom's Taxonomy.

## **Conclusions**

The instructor was able to overcome obstacles common to faculty-development of online courses by persistence and creativity. Her experiences can serve as an example of how faculty can develop exemplary

online courses regardless of level of computer skills. Ongoing feedback from students, and instructional design staff have resulted in ongoing modifications to best suit the needs of the students and the medium.

It is interesting to note that even though the instructor's presence had only a minor effect on the number and topic of interactions in each setting, her presence did cause a major shift in the level of thought reflected in the questions asked in each setting. Although the online review sessions had a higher frequency of interactions, these interactions consisted primarily of low-level questions which could be answered rapidly, both in terms of the amount of time required to think about the content and formulate a response as well as in the time required to physically type an answer.

The "anonymity" afforded by computer-mediated communication encouraged more in-depth thought and processing in student answers during the chat sessions. Students were more likely to participate, had more time to reflect and ask thoughtful questions compared to the lecture settings.

The main conclusion of this study was that it is possible to teach upper level science courses without sacrificing academic rigor. When face-to-face and online sections of the same course were compared, academic outcomes were the same, but the online classes demonstrated a deeper engagement with the content, and had a qualitatively different experience.



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# **ROOKIE CAMP: AN INTRODUCTORY UNIT FOR WEB-SUPPLEMENTED INSTRUCTION AT THE HIGH SCHOOL LEVEL**

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## **Abstract**

*Ease of use is critical to promoting success in computer-assisted instruction. The Rookie Camp unit is aimed at preparing high-school students for the WebCT working environment and provides explanation on how to be successful using WebCT. The unit was developed to introduce high-school students to the use of the icons and related course management tools on the "default" WebCT course homepage. This paper includes descriptions of the design, development and formative evaluation of the Rookie Camp unit. Implications for the future are based on the outcomes of the formative evaluation as well as findings from the literature review focusing on student support in computer- and web-assisted instruction.*

## **Introduction and Project Background**

Improving student success while reducing instructional costs can be a tremendous challenge for many higher-education institutions. It is interesting to note, however, that many high schools across the country are facing a similar challenge.

At one high school in the southwest, two staff members at the school teamed up to search for solutions to meet this as well as other academic challenges. Over a six-year period, they explored many scenarios, reviewed the literature, and participated in model projects. As a result of their efforts, they concluded that the use of technology in the classroom could possibly provide some solutions.

With the recent passing of a bond issue by the voters in the school district, funding for necessary capital equipment was secured. Among other things, the bond issue provided for installation of a high-bandwidth, high-speed infrastructure with access to the Internet during the 1998-99 school year. With the foundation in place, the challenge was on how to successfully utilize this system to meet the high schools' academic goals.

The team developed a proposal outlining ways to increase student success rates and decrease costs by using technology in the classroom. Some of the solutions proposed included providing web-supplemented additional learning activities and opportunities for students identified as "turnaround students", those students that are at risk of failing required courses. Other solutions offered opportunities for advanced students to take college level courses while in high school. Finally, web-based instruction could help those students who may not be able to be on campus for health, disciplinary, or other reasons.

Since it was unrealistic to expect teachers to become web developers immediately, the first project initiated was the development of a web-supplemented, rather than fully web-based, Freshman English class. The decision to begin with a web-supplemented course would allow for materials to be developed gradually, tested, evaluated, and revised (Dwyer & Boyle, 1999). Development of the course materials began in the spring of 1999 and the materials are being used at the present time.

## **Efforts to Expand the Use of Web-Supplemented Activities**

The high school chose WebCT to be the courseware used for web-supplemented instruction. In an effort to increase the use of technology in the classroom, members of an Arizona State University graduate

class, Advanced Instructional Development, were brought in to assist. During the semester, we spent time at the high school speaking with the school administrators, media director, teachers and students. Based on our meetings, we outlined several projects that would be of value.

### **Focus on the Learner**

Introducing and actually being successful in implementation of web-based courses is an arduous task. Many obstacles can present themselves quickly at the mention of utilizing the web as a tool for instruction. The difficulties may lie not only in gaining agreement with administration and faculty, but concern has to be given to the students who will be trying to increase their learning in this new environment.

Though it is probably true that many high-school students have some computer experience, relatively few have had exposure to using the web as part of their classroom instruction. In order to insure success, the learners need to be ready to work with this new tool. Learner readiness involves gaining competencies in using navigation tools and becoming familiar with the learning environment (Twigg, 1999; Winiecki, 1999).

In order to ease the transition to web-supplemented courses and promote success, the Rookie Camp unit was developed. This unit will become a "default tool" to be included in all WebCT courses at this high school. Rookie Camp will be the first unit the high-school students in web-supplemented courses will go through.

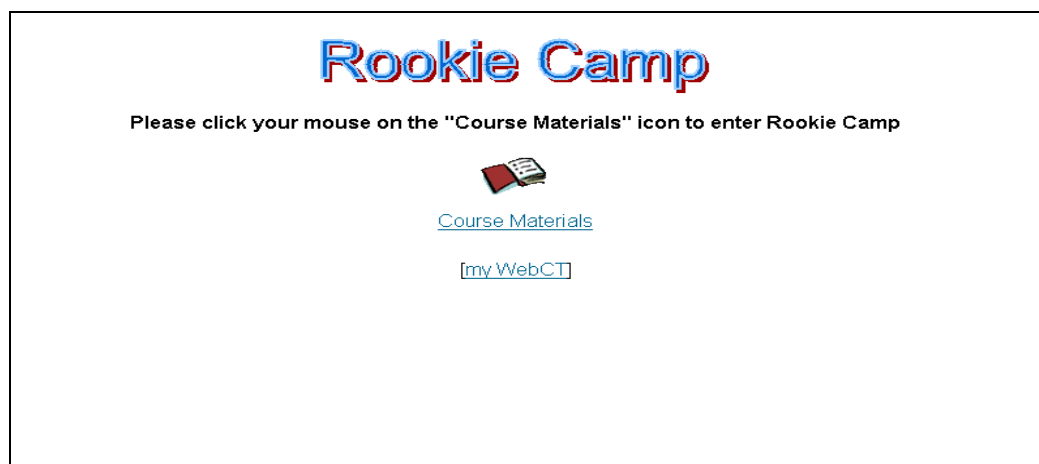
### **Description of the Rookie Camp Unit**

This unit is centered on a school or "Camp" environment, including graphics of students taking notes and a cheerleader leading the Rookie Camp Cheer. The unit is designed to make learning both effective and enjoyable.

Rookie Camp is a self-instructional unit in WebCT. Directions are provided to the student throughout the unit, along with reminders of the goals of the unit. The student is also provided a Rookie Camp Reminder Card. The Rookie Camp Reminder Card is a single sheet with a graphic of each of the nine "default" WebCT course homepage icons. The student is encouraged to write notes next to each icon on the Reminder Card as he/she is working through the unit.

### **Rookie Camp Instructional Flow**

The unit begins with a screen displaying the Rookie Camp title and asking the student to click on the "Course Materials" icon to enter Rookie Camp. (Figure 1) After doing this, the student is provided another screen with directions to click on the "Course Content" icon to begin using the Rookie Camp unit. This is the same manner in which the student will access all of their other courses in WebCT.




*Figure 1. Rookie Camp Introduction*

The student is then presented a Welcome screen with a description of Rookie Camp unit, followed by a screen, which shows a list of Rookie Camp Activities. The activities are an overview of the areas they will be working through in the unit. The student is then provided the actual learning objectives of the unit; after completing the Rookie Camp unit they will be able to provide the name of each of the nine "default" WebCT course homepage icons, and describe the tools the icons represent.

Since the student is not familiar with WebCT, WebCT and the "default" course homepage are explained. Next, the student is introduced to the Rookie Camp cheer: **McClintock Chargers Can Sure Learn Cool Stuff As Required**. The first letters of each word in the cheer represents the name of one of the nine WebCT icons. The student will be reminded of the cheer later in the program and told to use it as a learning tool, as it is a mnemonic device.

The student is then presented nine screens, each with a graphic of one of the icons and a detailed description of the uses of the icon. The descriptions provide information on how the student will use the tools represented by the icon for various course management functions. This section focuses on the actual learning objectives. A sample of an icon screen is shown in Figure 2.

## Calendar Icon



**The *Calendar* icon represents tools that provide a quick and easy way for you to find out about important dates in your course.**

**You will use this set of tools to find out when assignments are due, or when a test is scheduled.**

**The calendar tools will help keep you organized and on track.**

*Figure 2. Sample Icon Screen*

After working through the Rookie Camp sections concentrating on the names and tools represented by each of the nine WebCT icons, the student is then directed to work through the practice section of the unit. The student is again reminded that he/she is responsible for knowing the name of each icon and the tools each icon represents. The practice section consists of 18 multiple-choice type questions. For all of the questions, a graphic of one of the nine icons is shown. In nine questions, the student is asked to select the name of the icon from the responses provided, and in nine more questions the student is asked to select the tools represented by the icon from the responses provided.

When student has completed the practice section, he/she is told that the Rookie Camp Cheer can help in remembering the names of the icon. The student is then asked to come up with their own strategy for remembering the tools the icon represents. This is the review section of the unit. (In the final version of the unit, the student may be reminded that he/she can go back through the unit to review any of the icons they may have had difficulty learning. The student can go back to any section by clicking on the "pg back" button or by clicking on the hyperlink of the section displayed on the left side of the WebCT screen. This information is not provided in the prototype unit. Due to time constraints in the formative evaluation or try-out process, it was best for students to work through the unit in a linear fashion.)

The unit is then concluded. The student is then directed to complete the unit quiz and attitude survey. For purposes of the formative evaluation, a paper-based quiz was used. In order to program a quiz in the WebCT format, it is necessary to "attach" the quiz to information in a student database. This information was not available during the development of the unit.

## **Formative Evaluation of the Unit**

### **Procedure**

During the Spring 2000 semester, a formative evaluation of the Rookie Camp unit took place at the high school. The formative evaluation consisted of having students work through the entire unit and complete the unit assessment and attitude survey. The try-out was conducted in a Freshman English class. The teacher was beginning to develop activities in WebCT for her class, so was very interested in conducting the try-out with her students. The classroom was equipped with six computers with Internet access, so the teacher selected six students to participate in the tryout. Of the six students, three were considered "high-achievers" and three were considered "low-achievers". All students were ninth graders.

When I arrived at the classroom I accessed the Rookie Camp unit from each of the six computers. There were three computers on one side of the room and three on the other side of the room. The teacher was conducting class while I was readying the computers. Once the computers were ready, each of the students sat down at a computer. I gave them each a Rookie Camp User Guide and Rookie Camp Reminder Card. They were asked to read the User Guide and begin working. The Rookie Camp User Guide stated that Rookie Camp is a unit of instruction focusing on the nine "default" WebCT course homepage icons. In Rookie Camp they would be introduced to the names of each icon and the tools each icon represents. Since the unit covers a lot of material, it was suggested they take notes on the Rookie Camp Reminder Card. They were to work through the unit in its entirety making sure to read each screen carefully.

### **Unit Assessment Results**

The unit assessment was a paper-based instrument, as indicated earlier. There were nine sections with each section showing a graphic of one of the nine WebCT homepage icons. In the space next to the icon, the students were directed to write in the name of the icon, and describe the tools the icon represents.

Overall, students did well on the assessment. For all nine icons, all six students were able to provide the correct names of the icons, the first learning goal. Describing the tools the icon represents was slightly more challenging. The student's scores for this learning goal averaged 67% correct. In fact, one student did not provide a description for any of the tools of the nine icons; it is not clear if they did not understand the directions, did not remember any tool descriptions, or ran out of time - the change of class bell rang while some students were still completing the assessment.

### **Attitude Survey Results**

The attitude survey consisted of 10 4-item Likert type statements, and two open-ended questions. Summary of the Likert statements indicated that all six students agreed that the unit directions were clear, the unit was about the right length, they enjoyed the unit and would recommend it to their classmates.

The first open-ended question asked the students what they really liked about the Rookie Camp unit. Student responses included the directions being clear and the unit being simple and easy to use.

The second open-ended question asked students what would improve the Rookie Camp unit. The students suggested using more pictures and color. This is very interesting since there are pictures and/or color on all screens. One student indicated that there was too much content, while one student even stated that the unit was perfect!

In general, it appears that the students enjoyed working through the unit. For the most part, they were successful at learning the names of the icons, but still need additional instruction and practice in order to learn the tools represented by the icons. A revision to the unit should possibly include providing the student with practice activities using the icons and related management tools to complete various tasks.

## Implications for Learner Support

The Rookie Camp unit in WebCT provides students with an introduction to the elements with which they will be working in a web-supplemented learning environment. Ease of use is critical to promoting success in computer-assisted instruction. If the students continually need help in overcoming obstacles in the software, they will become frustrated quickly (Heinich, Molenda, Russell, & Smaldino, 1998). Based on these concerns, students using web-based instruction should become familiar with the navigational requirements of the system being used, as well as suggested study skills to enhance their success.

### **Additional Implications**

In addition to becoming familiar with the computer as a new learning tool, student success is also predicated on the use of successful study skills and learning strategies. Students participating in distance education courses have stated that improving study skills is a key element (Visser & Visser, 2000). The skills that students need in order to succeed in all forms of instruction, especially individual instruction, play an important role in effective learning in computer-assisted instruction. Some of these skills include planning and organizing for learning, and learning to apply skills developed in the classroom or paper-and-pencil environment to complete computer-assisted instruction (Cates, 1991).

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**STRATEGIES FOR CREATING AND SUPPORTING A COMMUNITY OF  
LEARNERS  
IN THE INSTRUCTIONAL SYSTEMS TECHNOLOGY  
DISTANCE MASTER'S PROGRAM AT INDIANA UNIVERSITY  
(CORE COURSES R511 AND R521/522)**

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**Abstract**

This paper presents strategies and rationales for implementing certain instructional techniques to move a class from cohort to community. The context is the new Distance Master's program in Instructional Systems Technology at Indiana University. The authors give suggestions for instructional and non-instructional strategies that have students interacting at the levels of discussion, cooperation and collaboration. These strategies are cross-indicated with their intended outcomes, that is, strengthening the feeling of community as defined by a set of characteristics, which are adapted from Schwier (in press). Suggestions for evaluation techniques are also presented, as are questions for further research.

**Introduction**

The shift from traditional classroom education to computer-mediated distance learning poses enormous challenges to instructors and learners. The concept of the classroom where students meet to interact with other learners and the instructor no longer exists. The instructor can no longer "look" around the room to see if students are attending to the material, bored or confused. Learners lack a natural social outlet to engage with other learners thus leading to feelings of isolation. The learner is now engaged with the computer instead of other learners. The big question for our project is "How do we structure the course design so learners have mechanisms to connect with each other and form community." How do we overcome the characteristics of the medium so that learners feel connected to the instructor and other learners?

The literature on effective teaching and learning promotes several "big ideas" that we used as foundations for our recommendations. These include Vygotsky's (1978) social development theory and the Seven Principles for Good Practice in Undergraduate Education (Chickering & Gamson, 1987). Vygotsky's social development theory states that social interaction is vital to cognitive development; all higher-order functions originate as the relationships among individuals. To scaffold learning we must require learners to interact with the content, the teacher and each other. Our strategies focus on promoting communication, social interaction and participation. Many of the principles, theories and strategies we encountered reflect the Seven Principles of Good Practice in Undergraduate education (Chickering & Gamson, 1987). At their core, each of the seven principles focuses on interaction. In 1996, Moore and Kearsley described three types of interactions that are necessary in distance education: learner to learner, learner to content and learner to instructor. We would argue that these three types of interaction are necessary in education regardless of where or how it takes place.



## Characteristics of Community

There is much discussion of learning communities, communities of practices, and virtual or online (social) communities. Although each type of community has its distinct characteristics and requirements, there are many things they share in common. What we are endeavoring to create will be a combination of all of the aforementioned communities: a community of practice (since our cohort will be from the same company) that is involved in mutual learning online. Because of these special characteristics, some things do not apply. For example, there is much talk in the virtual community literature about attracting members and defining the community based on common interests. In our case, this cohort is thrown together and “forced” to form community. Outside members are not encouraged to participate, mainly because the common interest in this case is “taking the Distance Masters in IST from IUB.” In a terrestrial community of practice, members might see each other at work, or meet in person once a week to deal with issues in their work lives. This will not exactly be the case for our community; although they will probably have some work issues in common, they are not a group of “teachers” or “nurses” or “engineers” who share vast amounts of experience and knowledge. Unlike an informal learning community, which spins itself from nothing and is based on a variety of people coming together for informal learning purposes and where the direction of both the learning and the community is malleable, our learning community will exist within strict parameters of this coursework. Obviously, members will be encouraged to bring other experiences and knowledge to bear on their coursework, but at the end of the day, the learning in question will be much more restricted than an informal learning community.

Selznik (1996) identifies seven elements of community: *history, identity, mutuality, plurality, autonomy, participation, and integration*. With respect to virtual learning communities, Schwier (in press) adds: an *orientation to the future, technology, and learning*. Some of these characteristics of community will be present from the beginning. Others, the cohort will have to grow into. We will describe the features of these 10 characteristics, and discuss how we will use them for our purposes.

Selznik notes that communities are stronger when their members share history and culture, rather than simply abstract general interests. Unlike an established terrestrial community, the nascent community forming from the distance education masters program will not have a shared *history*. Their history, like their identity, will have to grow and develop through their interactions with each other.

We believe that a shared sense of *identity* will develop in this cohort, and will strengthen their communal identity. Schwier’s suggested strategies for fostering identity include team-building exercises, developing community logos, and public acknowledgement of individual and group accomplishments within the community. He also notes the importance of articulating the “focus or purpose of the community” and outlining the requirements and rituals. The structure of the courses allows for frequent and obvious reiteration of community focus, and events such as orientation can help the group define its own rituals and norms.

The very fundamentals of a learning community require interdependence and reciprocity, what Selznik terms *mutuality*. Since our focus is on cooperative and collaborative learning, this mutuality will develop naturally. Schwier also recommends asking “leading questions that encourage members of the community to invest in concerns held by other members, and to share ideas and possible solutions” (p. 5). This type of interaction can be encouraged at course-level in the class forum, and on a social level in the Online Café.

We combined Selznik’s terms *history, mutuality, and identity* into a larger category called *group identity*. By combining these three concepts we emphasize the fundamental importance of group identity in fostering community. Although one of our goals in the next few semesters is to help students begin to construct a history relevant to their community, this is not something that can be imposed upon the group from outside. It has to grow from the sharing of each individual’s history and the links that the learners form with each other based on their experiences. These links are characterized by interdependence and reciprocity, in other words mutuality. Group identity results from this history and mutuality, and from making the budding community history public and available to all, especially newcomers.

*Plurality*, according to Selznik, results when many different types of interactions amongst members of a community occur, often rooted by individuals’ membership in other communities (work, neighborhood, church, etc.) that intersect. We replaced *plurality* with *social interaction*. Given a virtual community, one that to some extent is externally imposed, the opportunities for plurality are limited compared to those available to geographic communities. By providing opportunity for and the expectation of social interaction among participants, we purport the program will provide the plurality needed.

*Autonomy* of individual members within the community, especially within an academic setting, is important to foster. We will encourage thoughtful, personal postings within the forum, to avoid group-think

and “me too, I agree” contributions. Students will receive basic instruction on netiquette and will be encouraged to continually address evolving group norms to maintain respectful communication and to build consensus. We use *individual identity* in place of *autonomy* to underscore the importance of both group and individual identities within a virtual learning environment.

In the case of a virtual community, *participation*, both social and academic, is integral. Without active participation in discussions and other class activities, the learner is not part of the community; indeed, the learner does not even “exist.” This is one core distinction between being a passive member of a physical community where you are seen and your presence is noted and registered in the minds of others. In a virtual community, you must make a concerted effort to communicate with others in order to exist. At the same time, allowances must be made for learners to shape the participation, both in structure (number/kind of postings) and in content (managing the discussion of subjects interesting to them).

The *future orientation* of a learning community can operate at a number of different levels. A stronger community bond will be formed when a particular cohort goes through a number of courses together, moving toward their finishing the program and earning a degree. It can be argued that a learning community can develop within the constraints of a single four-month course, but it is much more likely that students will form long-lasting academic and social bonds throughout an entire program. Visioning exercises and direction of learning activities (having participants describe how what they learned will help them in future learning and in their work) can also give the community a focus on the future. In our case, the community’s view of the future may be limited to the two or three years they spend in the program. However, it is possible that they will continue to maintain community ties once they have earned their degrees and are working again. It is also possible that members of the Fall 2000 community would end up wanting to remain part of the Distance Masters community after they graduate, and would like to integrate themselves with the new incoming cohorts. This may pose particular problems of negotiation and fit; is there a role for graduated members to “return” virtually and engage with students working through the program?

Schwier notes that “the *nature of the learning* can be broadly defined and contextual” (p. 4) but is a necessary part of a virtual learning community. For our purposes, the learning involved is more specific and structured; the cohort moves through a set of core courses together, in a particular order. Our goal is to foster community among them before they finish the first year, so that although they will go on to take other courses with other distance learners, they will not only maintain ties with their initial cohort community, but will also have learned the foundations of virtual community creation and will use these skills in other classes. We have changed Schwier’s term *learning* to *knowledge generation*.

According to Schwier, “communities are built or dismantled by those in the communities, not by the people organizing or managing them” (p. 2). As they mature, communities define their own social rules of conduct and select their own leaders, assuming *ownership* of their governance and norms. Learning communities, note Palloff and Pratt (1999), exhibit evidence of socially constructed meaning, willingness to critically evaluate the work of others, again assuming ownership of their knowledge creation and sharing.

*Integration* of all of these elements is necessary for a strong community. Schwier suggests creating belief statements and evolving group norms, and adhering to a learner-centered philosophy that “supports individual expression while building a group identity” (p. 5).

Finally, *technology* is an important consideration for us: although it is thanks to certain technologies that virtual community-building is even possible, there are certain limitations put upon the group because of technology. Although it is the conduit for discourse, it can also exclude or discourage people. Tools that are complicated, unavailable for a certain platform, that are slow and cumbersome can all render the discussion process less than ideal, and members who do not actively participate essentially leave the community. Although Schwier recommends using technology compatible with older, less costly equipment to render the community more inclusive, this is not a concern for us.

Based on Selznik’s (1996) seven characteristics and Schwier’s (in press) additional three characteristics of community, we have assembled the aforementioned six key elements of community. From these elements, we define community as: a group of people who are brought together to share and generate knowledge in a mutually supportive and reciprocal manner. Its characteristics are ownership, social interaction, group identity, individual identity, participation, and knowledge generation. Furthermore, integration of all of these elements is necessary for a strong community.

Having defined some of the particular characteristics of a virtual community, we will now turn to some basic strategies for creating community. Palloff and Pratt (1999) recommend these steps:

- Clearly define the purpose of the group

- Create a distinctive gathering place for the group
- Promote effective leadership from within.
- Define norms and a clear code of conduct.
- Allow for a range of member roles.
- Allow for and facilitate subgroups.
- Allow members to resolve their own disputes (p. 24)

In our case, many of these steps are automatic, but they should still be given careful consideration. For example, the general purpose of the community is defined as “the Fall 2000 cohort for the IST Distance Masters program.” However, instructors or organizers may have more specific goals and purposes from the beginning, and even if they do not, other purposes may emerge from the community throughout the term. Pallof and Pratt (1999), surprisingly, do not put much emphasis on the communicative aspect of community without which a virtual learning community cannot exist.

We feel that one of the most important indicators of a learning community is the first: when students communicate not only on an academic level but on a personal level. Working together towards the goals of the course is what they are “supposed” to be doing. When they begin to talk about their personal lives (families, hobbies, jobs), their triumphs and trials with being a distance student (scheduling, technical problems, disagreement with pedagogy), when they seek each other’s counsel for other areas of their life (job change, which elective course to take next, family issues), this is the point at which we feel they are comfortable as a community. There is a good chance that not everyone will be everyone else’s best friend. However, when a majority of the members feel they are in a safe enough space to “speak up” about things in the public forum, rather than in individual e-mail messages, then this is evidence of a successful community. There may be a few members of the community who do not feel that the Online Café is an appropriate place to discuss non-academic subjects, and it is the role of the mentor and the community members to make the Café a welcoming place for this type of discussion. As in every type of community, there will be some people who opt out of certain discussions, or even out of all “non-official” discussion, but this is quite normal. There will probably be smaller communities within the larger online class, people who form bonds and discuss the course work and their lives, but not on the general forum. These differences can appear for a variety of reasons; Eastmond (1995) found divisions on age, gender, experience, and learning style lines. However, he also found that the groups often transcended age and gender, for example, two characteristics that might, in a traditional classroom, be impediments. The final step in creation of an online community is to evaluate whether a community has formed, and if so, in what ways has the community aspect contributed to learning. Our project will address methods for performing the first evaluation of whether community has formed.

## **Definitions**

We will examine ways to use certain instructional strategies to work to move the cohort toward a community. We suggest encouraging interaction at three levels: discussion, cooperation, and collaboration.

### **Cohort**

The cohort is the group of students going through the core classes as a group. They may have an initial connection, such as a common employer, but it does not necessarily constitute a strong bond.

### **Discussion**

Discussion is the basic means of communication in an online format. Students must participate in discussion to have any sort of presence in the class whatsoever. Discussion can be focused around readings, lectures, and any other ideas based on course content or course administration. Discussion can occur asynchronously in the SSF or via e-mail, or synchronously via chat rooms or telephone.

### **Cooperation**

Cooperation entails students working in groups or otherwise dividing up tasks. A machine metaphor can illustrate cooperation in the classroom: different parts of the machine perform different functions and goals, but work together towards a similar end. For example, students may divide up a project, but are eventually assigned individual grades for their work. Examples of cooperative tasks include: dividing up sections of a report to write and doing peer review of each other’s work.

### **Collaboration**

Collaboration is the most integrated form of group work, and is therefore potentially the most difficult and the most rewarding. In the case of collaboration, the group members work toward a common goal, one that carries a mutual investment. For example, students may each work on every part of the

report, consulting each other and re-reading each other's edits. They are invested in every part of the project because they will share a common grade. Examples of collaborative tasks include group writing and creating an ID model.

## Community

A virtual learning community, as described in the introduction, is one of the ultimate goals of the core courses.

The three levels of interactions can be compared by several characteristics, as in the table below.

	Discussion	Cooperation	Collaboration
<b>Learning</b>	Information transmission	Knowledge transmission	Knowledge generation
<b>Inquiry</b>	Individual inquiry	Delegation of tasks	Common inquiry
<b>Decision-making</b>	Agree to disagree	Vote (majority rules)	Social negotiation to consensus
<b>Goals/agendas</b>	Multiple goals/ multiple agendas	One goal/ multiple agendas	One goal/ one agenda
<b>Accountability</b>	Individual accountability	Individual accountability	Group accountability
<b>Learning relationship</b>	Complete independence	Partial interdependence	Complete interdependence

## Description of IST Core

The term "Core" is used in the IST department to denote four courses that all graduate students take in their first year in the program. Traditionally R511 (2 credits), R521/522 (4 credits), R580 (1 credit) are offered in the Fall term; R561 (3 credits) is offered in the Spring. It is usually the case that the new students (both Masters and Doctoral) take these classes as a group; they form a cohort that goes through at least the first year of courses together. The cohort identity is important to the IST program, and it is something that will be actively cultivated in the online Masters program. Tangential to the cohort identity is the community-building that is undertaken to integrate new students into the IST program. The social aspect of the community is nurtured through happy hours, the IST picnic in the fall and the Follies show in the spring, and informal pairing new students with old ones. Academically, the IST community is built through the identity of the Rookie cohort, through the rookies taking non-Core classes (R547, Y520, etc.) with upper year students, through rookie interaction with upper year AIs in Core and non-Core classes, etc. The IST department is also very much linked to its alumni, through alumni presentations in R580 (Grads with Gigs) and networking at conferences.

The pedagogy is rooted in project-based learning and team-based work. Much of the learning is hands-on, and students often work with real-world clients. There is a focus on an integrated curriculum and many of the courses are team-taught. The different research areas of the faculty (for e.g., corporate vs. higher education vs. K-12) expose all students to multiple academic perspectives. The international nature of the program (approximately one-third of the students are non-U.S. citizens) exposes all students to different ways of learning and working. Because of the content, there is an emphasis on technological competence, although the skill levels of both entering and graduating students vary immensely. Although the use of technology in education is important to IST, technology is a means, not an end, and its use is firmly rooted in pedagogy.

The associations that IST has with other departments, including Educational Psychology, Language Education, the Kelly School of Business, the School of Library Science, etc., contribute to an integrated and interdisciplinary academic environment. Most of these departments offer online courses that can be used by Distance Masters students as electives.

## Core Instructional Strategies and Rationales

Ownership	Know. Gen.	Ind. Identity	Shared Iden.	Social Inter.	Participatio	Strategies	Rationale
✓		✓	✓	✓	✓	Students participate in a face-to-face orientation on campus.	Face-to-face interactions allow to people to create strong initial bonds, which will lead to

Ownership	Know. Gen.	Ind. Identity	Shared Iden.	Social Inter.	Participatio	Strategies	Rationale
							a greater sense of community right from the beginning.
✓	✓			✓	✓	Students will learn about online communication, including rules of netiquette	Online communication is vastly different from more traditional forms of communications (Black, 1995).
	✓			✓	✓	Students will undergo training in using SiteScape Forum, e-mail, majordomo creation, basic web searches, and MS Word for collaborative writing purposes.	To help reduce barriers to effective learning and establishing social relationships, participants should be given the opportunity to build confidence and competence with the distance education process and supporting technologies (IDE, 2.2).
		✓	✓	✓		Students will post photos of in SiteScape Forum at Orientation.	Connecting people's names and faces is a first big step to forming bonds.
✓	✓		✓	✓	✓	Students will participate in a content-based group project that requires that they negotiate the exact content.	People will form strong personal and academic bonds through shared adversity (Ruhleder, 1999).
			✓	✓		Students will be required to eat lunch as a group two days during Orientation.	People who have a social connection to the group will work better together (Palloff & Pratt, 1999).
			✓	✓		Students will be given the opportunity to participate in at least two evening social activities.	People who have a social connection to the group will work better together (Palloff & Pratt, 1999)
		✓			✓	First posting should be a non-graded/non-credited assignment (e.g. biography).	Students need non-threatening, interesting ways to begin creating online community (Funaro, 1999).
✓	✓	✓	✓	✓	✓	Create an online café that will serve as a non-course-specific conversation area to encourage off-task communication.	People need distinctions between work and play (Palloff & Pratt, 1999).
		✓	✓	✓	✓	Encourage instructor and distance mentors to participate in social interactions, especially in the early stages of the course.	Social interactions between and among learners enrich the learning community and should be supported in the instructional design of the course (IDE, 2.5).
		✓	✓	✓	✓	Students will be encouraged to share, in the online café, information about their non-academic lives, for example, offering mutual support in term of how they are keeping up with their job and school schedule. Students should be encouraged to offer successful strategies to the class.	Reciprocity and help are two important hallmarks of community. Students who take an interest in each other's well being, both academic and social, will have more of a support system of peers than those who do not (Wellman & Gulia, 1999).

## R511 Section

### Description of R511 (from course syllabus)

R511, Instructional Technology Foundations I, is a two-credit course that has historically been offered each fall semester. This course is required by all IST Masters students and is typically taken

concurrently with R521/522, Instructional Design and Development, and R580, IST Colloquium. It is team-taught by two faculty members and one graduate assistant who has taken the course.

The overall objective of this course is to provide a comprehensive introduction to the field and profession of Instructional Technology (IT). Since most entering IST students come from fields other than instructional technology, R511 gives newcomers a sense of history and an explanation of how the components of the field fit together. There is a particular emphasis on the evolution of the “big ideas” of the field.

In the onsite version of R511, class meetings occur once per week in 2-hour sessions. Directed readings compiled in a course packet are provided as practical resources to support assignments and class discussion activities in the course. Most class periods are divided into two portions: 1) During the first hour, each of the three instructors facilitates a group discussion among 15-20 students about assigned readings. 2) The remaining portion of the class time is devoted to further lecture and clarification about topics contained in the readings.

Students are graded according to participation in class discussion, personal synthesis and reflection (as noted in weekly minute-papers collected at the end of each class), three individual written essays (one team-based, two individual), and a final exam or written essay.

### **R511 Instructional Strategies and Rationales**

Ownership	Know. Gen.	Ind. Identity	Shared Iden.	Social Inter.	Participatio	Strategies	Rationale
					✓	A fundamental element for success for the distance students is an understanding of the key expectations <ul style="list-style-type: none"> <li>- how much time the course will require</li> <li>- the level of performance that is expected of them</li> <li>- the demands that participating in the core will have on their time.</li> </ul>	Students, but especially students learning at a distance, need to have expectations, assumptions, deadlines, etc., made explicit and kept clear (Palloff & Pratt, 1999). Understanding and respecting expectations for participation and performance will be critical to the students' success. Taking Core online will be more demanding than doing it face-to-face.
	✓	✓		✓	✓	Instructors will assign discussion roles (facilitator, summarizer, devil's advocate, etc.) to encourage shy members and force students to think in different ways about the material and about the discussion of the material.	Students should be challenged to engage the material from different perspectives; different roles improve learner-learner interaction and improve learner-material interaction.
	✓		✓		✓	Students will be expected to take part in regular peer reviews by critically evaluating each other's papers.	It is important to develop a critical eye towards other community members' work.
✓	✓				✓	Each week, someone from each group will summarize their group's discussion and post the results for the other groups to read.	Bringing from small groups to the larger group provides for more viewpoints and better discussion.
	✓		✓		✓	Students will be divided into 3-4 small groups for discussion of readings and course projects.	Small groups facilitate better discussion (Hiltz, 1998) for learner-material interaction.
✓		✓			✓	Students will fill out weekly “1-minute evaluation” web form, to instructor only. Possible topics include what you liked/disliked about the week's work, how you can transfer	To better assimilate and process what they have learned, students require a forum to critically reflect on the material and on themselves as learners (Palloff & Pratt, 1999). Keeping in touch with the

Ownership	Know. Gen.	Ind. Identity	Shared Iden.	Social Inter.	Participatio	Strategies	Rationale
						this knowledge to your work, and generally how you are feeling.	professor improves learner-faculty interaction.
	✓		✓		✓	Instructors will require high-quality online interactions with peers and discussions of readings by making a portion of the grade dependent on it. (We recommend at least 25%).	Effective learning environments should provide frequent and meaningful interactions among learners. (IDE, 2.1) Good practice encourages cooperation among students (Chickering & Gamson, 1987).
	✓			✓	✓	Instructor and/or mentor will model ways to produce lively, constructive discussion: questions should be open-ended, but focused on students' interpretation of the text.	One of the best ways to keep discussion on topic and students motivated is to participate actively in the conversation (Beaudin 1999).
✓	✓	✓			✓	Instructor will point out excellent discussion, postings, interactions, etc. of other students to continually promote high expectations and model good interaction.	Good practice encourages prompt feedback (Chickering & Gamson, 1987). Faculty-learner interaction improved by attentive professor.
✓			✓	✓		As needed, instructor will revisit netiquette and general interaction issues, and stresses the importance of interacting in a respectful way. Have the community develop group norms based on emergent issues.	Social negotiation leads to the creation of a safe space, which is essential for learning (Palloff & Pratt, 1999).
					✓	Students will be expected to check SiteScape Forum and e-mail every two days and post quality contributions at least twice a week. Participation points will be calculated based on these postings.	Because of the nature of the evolving discussion, students should be constantly engaged in the course, without any lengthy absences from discussion. (Caldwell & Taha, 1993)
✓		✓	✓		✓	The instructor/AI should make contact with students who are not actively participating to find out why and address their concerns.	Students need to actively feel like they're part of the community, and that the instructor is interested in their well-being, academic or otherwise (Palloff & Pratt, 1999).
	✓		✓		✓	Students will work together at all three levels of interaction: - Discussion - Cooperation - Collaboration	In order for a newly-formed cohort to move to community, they must change the quality of their interactions. The community should move toward successful use of collaboration, in addition to the continued use of group discussions and cooperative tasks.

### R511 Assignment Specifications

Based on the existing assignments for R511, we have developed a set of projects and assignments that will both address the traditional content of the course, and build community based on the discussion, cooperation, and collaboration model. Where we realize that collaboration is a more rich form of thinking and working together, we also emphasize the necessity for students to work at all three levels of interaction throughout the course.

## Discussion

- At the beginning of the semester, students will be divided into readings discussion groups of 3-4 people. For purposes of community and continuity, they will remain in these groups throughout the semester.
- In SiteScape Forum, a team will be created for each readings discussion group. The group will manage that space, and can create folders for each week's readings if they so choose.
- The students will be expected to discuss the week's readings in their respective folders. Each student should post at least twice each week.
- The role of facilitator in each discussion group will rotate from week to week. The facilitator must start the conversation, and engage group members to participate.
- The role of summarizer in each discussion group will rotate from week to week. At the end of the week, the summarizer must condense the group's main discussion points, and post them to the class forum (outside the team space).
- There will be a separate folder in SiteScape Forum for discussion of the week's lecture or class activity. These posting requirements will be determined at a later time, dependent on the format of the course lecture material.

## Cooperation

### "Letter Home" Paper

Students will review each other's papers in formative stages. For the "letter home" assignment, students will post outlines and rough drafts by set deadlines, and a selected group of peers (ideally from outside their reading group) will have to read and give feedback on them. The rationale for a number of small deliverables leading to the final paper is that distance students traditionally need regular deadlines and prompt feedback.

### Final Exam Study Guide

Students can still help each other out on breaking down the study guide and elaborating on certain sections of it. This could be left open for students to determine, just as in the traditional R511 class. Simply make the suggestion to the students that they may want to work together on fleshing out the study guide, and leave it to them to decide how they want to do it.

## Collaboration

### ID Model Paper

The students will collaborate on the ID model paper as in the traditional R511 class (using their reading discussion teams as the groups). In the distance version, however, it will be critical that this process be divided into small deliverables. For instance, the students might be required to break down the task into the following deadlines:

- *Week One:* Each group member must post initial ideas of possible models to evaluate or create. This is not in any formal structure – just a brain dump. Each group member must read and respond to the discussion.
- *Week Two:* Group must decide on a model and begin explicating the model and describing its strengths/weaknesses. All group members should be posting during this week.
- *Week Three:* Someone in the group should summarize the discussion into a paper outline. Another group member should develop a paper draft. One or two group members should make suggested changes and revisions. The final group member should write the final draft and post it.

### "ism" Debate

Students will participate in group debates revolving around behaviorism, cognitivism, and constructivism. Ideally, students will be placed into 3 groups that are different from their reading groups. Each group will be assigned one of the "isms" to represent in the debate. Here, a proposed timeline for the debate:

- *Week One:* Individuals will write an informal short paper (one page – perhaps even as a bulleted list) highlighting the major strengths of their "ism" as it applies to distance education courses and will post it for their teammates. Next, the team will enumerate possible rebuttals from the other groups and responses to those arguments. The first week's discussion and postings will all take place inside a new folder established for that team.
- *Week Two:* One student from each group will post an argument about why their position is the best to a debate folder open to the whole class. Each group will respond to each of the other groups.



- *Week Three:* Debate will continue.
- *Week Four:* Each individual will write a brief reflection on how their opinion changed throughout the debate.

## **Checklist for R511 Instructor/Mentor**

### **Orientation**

- ☐ Attend Sunday night dinner with new DE students.
- ☐ Participate in 2-hour R511 class welcome session.

### **Beginning of Semester**

- ☐ Create teams in SiteScape Forum for each readings discussion group. Using a naming structure like jewels (Opal team, Ruby team, etc.) is an easy identifying factor.
  - o Divide students into the groups evenly. Make sure the instructor and GA are listed as members of all teams.
- ☐ In SiteScape Forum, create a Discussion & Document Forum entitled “R511 Lecture and Class Activity Discussion.”
- ☐ In SiteScape Forum, create a Discussion & Document Forum entitled “R511 Resources & Tidbits”
- ☐ Create a class majordomo.

### **Weekly**

- ☐ Check that all class members have posted at least twice about the readings.
  - o If not, make decision about contacting that person via e-mail.
- ☐ Check that all class members have posted about the lecture/class activity.
  - o If not, make decision about contacting that person via e-mail.
- ☐ Post some comments to the Online Café. This could be
  - o News stories
  - o Responses to other students
  - o Encouragement
  - o Personal comments
  - o IST/DE news
- ☐ Reply to at least 2 postings a week, to encourage students to post thoughtful responses and to show that you are present and actively following the discussions.

### **Before the “ism” Project**

- ☐ In SiteScape Forum, create the following three teams: Behaviorism, Cognitivism, and Constructivism.
  - o Divide students equally among the three teams. Make sure the instructor and GA are listed as members of all teams.

### **Before the “Letter Home” Paper**

- ☐ In SiteScape Forum, create the following five teams: Peer Review Group 1, Peer Review Group 2, Peer Review Group 3, Peer Review Group 4, and Peer Review Group 5.
  - o Divide students equally among the five teams. Make sure the instructor and GA are listed as members of all teams.

## **R521/522 Section**

### **Description of R521/522 (from course syllabus)**

R521/522, Instructional Design and Development, is a four-credit course that has historically been offered each fall semester in an onsite format. This course is required by all IST MS students and is typically taken concurrently with R511, Instructional Technology Foundations I, and R580, IST Colloquium. It is team-taught by at least two faculty members and one or two graduate assistants who have taken the course themselves.

Major content and experience objectives of R521/522:

- Knowledge of instructional design principles
- Knowledge and application of the ADDIE model of instructional design and development

- Understanding and application of simple formative evaluation processes
- Ability to recognize and employ fundamental principles and experiences in team-based approach to project work

Pedagogical methods used in R521/522:

- Task-oriented learning through “authentic” projects
- Diverse, team-based project groups
- Mentor/coach-based instruction for project team support
- Structured timeline of deadlines and deliverables
- Independent learning, i.e., students take responsibility for their own learning
- Assignments with specific criteria that engage students in learning specific course content, with leeway given for students to identify their own topics

Most of the learning in the course occurs within the context of projects and situations similar to those that instructional designers encounter in professional work. Projects are sequenced such that the processes and principles learned in the first ones provide foundation of understanding and competence for progressively more complex ones that follow. This progression of increasingly elaborated projects continues through the academic year into R561, Evaluation and Change Management, and is intended to carry on throughout the student’s academic experiences in completing the IST MS program.

In the onsite version of R521/522, class meetings occur twice per week in 2.5 -hour sessions. Class sessions involve one or more of a variety of activities, including lectures or presentations about specific topics, readings discussions, project group meeting time, group project presentation, or hands-on design activities. Directed readings compiled in a course packet are referenced as practical resources to support projects and class discussion activities in the course.

The instructors believe that people learn best when they are highly motivated and actively engaged in learning tasks, that learning is most useful when it is directly related to learner needs. Thus, students are expected to take responsibility for their own learning. The course begins with a fair amount of guidance from the instructors, in terms of what information to access and how to facilitate personal learning, then gradually decreases that guidance to require students to actively seek resources on their own to perform the assigned tasks.

Major projects in R521/522 are completed by groups of three students, each mentored by an assigned instructor “coach.” To perform most satisfactorily in the course, students must spend many hours per week outside of class developing and completing these projects. At the completion of a project, each member of a given group is awarded the same grade (a “group grade”) as his/her teammates. Approximately twenty percent of that grade is awarded for the deliverable produced in the project (e.g., the instructional tool developed and a design report), whereas the remaining portion of the grade is awarded according to the way members worked within the team setting. Some students come into the program with extensive background in true teamwork, but most do not. Thus, the instructors devote a portion of instructional time early in the semester toward preparing students for the team experience. Throughout the duration of each project, group coaches continue to offer advice and guidance for the team process.

#### R521/522 Instructional Strategies and Rationales

Ownership	Know. Gen.	Ind. Identity	Shared Iden.	Social Inter.	Participatio	Strategies	Rationale
	✓					Learners will be divided into 3-4 groups for discussion of readings and course projects.	Small groups facilitate better discussion. (Hiltz, 1998)
✓	✓		✓		✓	Provide criteria that define appropriate course topics, leaving room for choice and opportunities to leverage work-related projects as course projects. <ul style="list-style-type: none"> <li>• Learners select a topic and procedure for project.</li> <li>• Each team selects 4 readings to</li> </ul>	In order to build community, learners need ownership. (Schwier, in press)

Ownership	Know. Gen.	Ind. Identity	Shared Iden.	Social Inter.	Participatio	Strategies	Rationale
						read and summarize for the whole class (for discussion)	
✓	✓				✓	Each week, someone from each group will summarize their group's discussion and post the results for the other groups to read.	Bringing from small groups to the larger group provides for more viewpoints and better discussion.
	✓		✓		✓	Students will be divided into 3-4 small groups for discussion of readings and course projects.	Small groups facilitate better discussion (Hiltz, 1998) for learner-material interaction.
	✓		✓		✓	<p>Instructional activities will require the learner to actively participate in the acquisition and processing of educational content.</p> <ul style="list-style-type: none"> <li>• Team-based authentic projects where the learners learn by doing.</li> <li>• Discussing readings online and role-playing.</li> <li>• Require high-quality online interactions with peers and discussions of readings by making a portions of the grade dependent on it (25% recommended)</li> <li>• Groups will be responsible for posting some of their work in progress (e.g., each group posts a description of a different aspect of ADDIE).</li> <li>• Instructor should use open-ended questions to encourage dialogue.</li> <li>• Ask learners to provide URLs that enhance learning.</li> </ul>	To better assimilate and process what they have learned, students require a forum to critically reflect on the material and on themselves as learners (Palloff & Pratt, 1999). Keeping in touch with the professor improves learner-faculty interaction.
	✓				✓	Instructor will phone each learner before class begins. (Spear & Bruce, 1997)	One-on-one verbal communication between learner and instructor solidifies relationship.
	✓				✓	Establish a virtual office hour: one hour where instructor will be available for online chats, office phone calls, or e-mail. Inform learners of the faculty member's expected e-mail or voicemail response time, e.g., within 24 hours, twice a week, etc. (Spear & Bruce, 1997) (Spear & Bruce, 1997)	Students like to know the professor is available at a particular time to address e-mail concerns.
				✓	✓	Instructor will be proactive, following up on the learner who is not participating in chats, discussions, etc.	In the distance format, it is easy for students to lose touch with the class and slowly drop out. Active intervention from the instructor can lessen attrition.
✓	✓		✓	✓		Conduct a phone conference with each team at least once during the	Verbal communication between the team and instructor solidifies relationship and

Ownership	Know. Gen.	Ind. Identity	Shared Iden.	Social Inter.	Participatio	Strategies	Rationale
						development of each project.	makes for easier clarification.
✓	✓				✓	Invite other professors to lead discussions (Davies and Reigeluth on concept learning) where learners can interact directly with experts to deepen understanding.	Students will appreciate input from experts in the field. They will feel less isolated from the rest of the department when they can interact with other instructors.

## R521 Assignment Specifications

Based on the existing assignments for R521, we have developed a set of projects and assignments that will both address the traditional content of the course and build community based on the discussion, cooperation, and collaboration model. The students will collaborate on production projects, discuss readings or lecture topics, and reflect on activities and experiences throughout the course. While we realize that collaboration is the richest form of thinking and working together, we also emphasize the necessity for students to work at all three levels of interaction throughout the course.

### Discussion

#### Readings

Discussion activities centered around the course's major themes (e.g., usability, design, evaluation).

- At the beginning of the semester, students will be divided into readings discussion groups of 5 people (different from those in their project groups). For purposes of community and continuity, they will remain in these groups throughout the semester.
- In SiteScape Forum, a team will be created for each readings discussion group. The group will manage that space, and can create folders for each week's readings if they so choose.
- The students will be expected to discuss the assigned readings in their respective folders. Each student should post at least twice each week.
- The role of facilitator in each discussion group will rotate from assignment to assignment. The facilitator must start the conversation, and engage group members to participate.
- The role of summarizer in each discussion group will rotate from assignment to assignment. At the end, the summarizer must condense the group's main discussion points, and post them to the class forum (outside the team space).

### Cooperation

#### Group projects

- At the beginning of each project, students will be divided into groups of three. Each group will work collectively to complete its own project. A team "coach" (an instructor or graduate assistant) will be assigned to each group to offer advice and guidance for the team process.
- In SiteScape Forum, a team will be created for each project group (including the course instructors and mentors). The group will manage that space.
- Groups will be required to post all team meeting summaries and other artifacts of their team processes on the forum.

### Collaboration

#### Group projects

- For each project, the team will be intentionally diverse in gender, nationality and/or job background as much as possible to encourage multiple points of view.
- Projects will be assigned group grades, a large portion of which is assigned to the "group process."
- Give project rubrics, teams will be encouraged to brainstorm possible topics and come to consensus to identify their own topics for projects.

- Teams will engage in formative peer reviews of each others' projects and materials for projects throughout the course.
- Lectures and course topics will be presented by different instructors throughout the course, providing a model of collaboration for students.

## **Checklist for R521 Instructor/Mentor**

### **Orientation**

- ☐ Attend Sunday night dinner with new DE students.
- ☐ Coordinate a team-based project that emulates the required peer interaction and interdependence and time-limited working tensions of R521 production projects.
- ☐ Post expectations (time, participation, assignments, dates)

### **Beginning of Semester**

- ☐ Create teams in SiteScape Forum for each readings discussion group.
  - o Divide students into the groups evenly. Make sure the instructor and GA are included as members of all teams.
- ☐ In SiteScape Forum, create a Discussion & Document Forum entitled "R521 Lecture and Class Activity Discussion."
- ☐ In SiteScape Forum, create a Discussion & Document Forum entitled "R521 Resources & Tidbits"
- ☐ Create a class majordomo listserv and direct all class members to subscribe to it.

### **Weekly**

- ☐ Post some comments to the Online Café. This could be
  - o News stories
  - o Responses to other students
  - o Encouragement
  - o Personal comments
  - o This week in IST
  - o Post reflection questions each week

### **Beginning of Each Project**

- ☐ Create teams in SiteScape Forum for each project group.
  - o Divide students into the groups evenly. Make sure the instructor and GA are included as members of all teams.
- ☐ Direct each team to construct and post its own individualized strategies and timeline for conducting the team process and completing its project.

### **Throughout Project**

- ☐ Check that each project team is posting evidence of cooperative work on project at least once per week.
  - o If not, make decision about contacting that group via e-mail.
- ☐ Reply to at least 1 or 2 postings a week per group, to encourage students to post thoughtful responses and to show that you are present and actively following the discussions
- ☐ Check that all team members are participating at least once every two weeks within their own project teams

### **End of Project**

- ☐ Review reflection essays from each team member about lessons learned from the production and team processes
- ☐ Collect peer grading of team members' participation within each team

### **Evaluation**

The final step in the creation of a learning community in these courses is to evaluate whether such a community has formed and, if so, in what ways the community aspect has contributed to learning. We are

basing our strategies for evaluating the success of community-building in these courses on Palloff & Pratt's (1999) indicators that an online community has been forming:

- Active interaction involving both course content and personal communication.
- Collaborative learning evidenced by comments directed primarily student to student rather than student to instructor.
- Socially constructed meaning evidenced by agreement or questioning, with the intent to achieve agreement among students.
- Sharing of resources among students
- Expressions of support and encouragement exchanged between students, as well as willingness to critically evaluate the work of others. (p. 32)

The course evaluations will take two forms: Formative evaluations are undertaken throughout the course so that necessary adjustments in course delivery and activities can be identified and made. Summative evaluations are performed at the conclusion of the course to measure final learning outcomes and student satisfaction. Both forms provide fundamental indicators of the overall success of the course and its participants in meeting the initially stated objectives. Palloff & Pratt recommend employing evaluations over three distinct elements of a online course: student performance and learning, effectiveness of the course in supporting student learning objectives, and overall student experiences of the students in working in an online environment. For our purposes of assessing community formation, the emphasis on student performance is most the most important factor on which to focus.

We have stated already that two key indicators that the evolution of a community has occurred are evidence of participants accepting ownership of the community and realizing a shared identity. The metaphor of scaffolding activities and course strategies as mechanisms to foster community implies that the instructor provides models and activities to course members through which they exercise community-like tasks and interactions. These scaffolds are erected as temporary measures to support the desired behavioral outcomes until observed behavior indicates they are no longer used or needed, then they are gradually removed. Concurrently, formative evaluation that measures indicators of the extent to which online community is occurring becomes the key factor in determining the necessity and lifespan of each scaffolding device.

Suggested methods for formatively assessing the level of online community throughout the duration of the courses are as follows:

- Continually monitor the amount, type and effectiveness of discussion in all media, particularly student-to-student discussion
- Administer periodic interviews and web-based questionnaires to students to gather qualitative feedback about reactions to the level of community they are experiencing and its usefulness to their learning
- Look for evidence within all communication media of resource sharing and/or inter-community encouragement or support
- Compare progression of reflective essays of students to identify evolution of self-assessments that indicate personal commitment to the community or deepening of learning and thought about key issues discussed among members

We do not anticipate that a mature community will have been generated from this one semester alone. However, we do expect that the R521 and R511 experiences of these students will create a solid foundation of an infant community that will continue evolving throughout their career in the IST DE MS program. Summative evaluation in the context of assessing community building is useful for determining the overall effectiveness of the online community environment on the students' experiences both during these courses and in future ones.

Suggested methods of summative evaluation are as follows:

- Compare pre-and post-course attitudes of students regarding confidence with working collaboratively with a distributed or online project team
- Compare pre- and post-course opinions of students regarding their comfort levels with and reactions to collaborative projects
- Assign a final reflective essay in which students describe a personal action plan for applying the experiences and knowledge gained through the course, specifically those relating to collaboration and communities

- Perform longer-range (e.g., 2-3 months later) follow up interviews and surveys with students that engage them in reflection on the impact of community and collaboration on courses taken after R521 and R511

Finally, we intend these strategies of evaluating community building in R521 and R511, although holistic in spirit, merely as a framework on which more specific and precise assessments can be constructed. We believe deeper exploration of success factors in fostering online community would be a very fertile topic for further research and warrants further investigation.

## Questions for Further Research

Beyond the evaluation of the success or failure of community in the Fall 2000 Distance Masters Core, there are other topics worthy of research.

- What are some valid measures of community development?
- If community formed, what was its effect on the learning?
- How can learners be motivated to take part in virtual academic or social community activities?
- What are special features of “forced community” like the Masters cohort?
- What is the expected/observed life cycle of the Distance Masters learning community?
- How does this community develop and maintain its history?
- Should the Distance community be integrated with the residential graduate community? If so, in both academic and social ways? If so, how can this be accomplished?
- How can the community best be mentored?
- What are the different roles for instructors, graduate assistants, volunteers, upper-year IST students, etc?
- What communication/collaboration tools foster the development of a learning community?
- What are the best practices for using existing communication tools in distance education?
- What tool features lend themselves to different aspects of collaboration and community-building?
- How appropriate were the tools chosen for Fall 2000 in terms of collaboration and community formation?

## Conclusion

Having determined that richer learning takes place within the context of a learning community, this report provides background descriptions of characteristics of community and, more specifically, a virtual learning community. We discuss the goal of moving a cohort to a learning community through scaffolding activities rooted in the communication formats of discussion, cooperation, and collaboration.

The report then treats the Core classes in three separate sections: Core (principally orientation and the online café), R511, and R521/522. The courses are described, instructional strategies and rationales are presented, possible assignments are detailed, and an instructor checklist is provided.

Finally we thought it necessary to determine some strategies to evaluate a) whether community has formed within the cohort, and b) in what ways the community contributed to deeper learning. We also provide some possible topics for further study.

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# A DESIGN OF ELECTRONIC PERFORMANCE SUPPORT SYSTEMS

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*Acknowledgements: Special thanks to Charles Graham and Polly Rastogi who have spent many hours developing the system.*

## Abstract

*The purpose of this paper is to provide an overview of what steps were taken to create an electronic performance support system (EPSS) prototype for Instructional Systems Technology (IST) doctoral students to help them prepare for the Qualifying exams. Throughout the design and development process of the EPSS, the principles of socio-technical design and knowledge management were used. To allow for a participatory design, we used a qualitative approach to collect data, and this was followed by interactive designing of the prototype. We used rapid prototyping and usability testing so that the prototype would be customer driven and meet the needs of the end users.*

## 1. Introduction

*The project described in this paper was organized to build a supportive environment for IST doctoral students at Indiana University-Bloomington to help them prepare for the Qualifying exams. We seek to improve productivity by honing the skills and tools they need and providing a supportive environment where students can collaborate and seek advice from each other during preparation. During the process, the concepts of information, collaboration technology, learning and work style, tools and management became important in building the support system. The perspective of socio-technical design, knowledge management, and human approach were applied throughout the process.*

*This paper covers the process of designing this system. With reference to the screen shots and the reflections to the design challenges, we hope to instigate readers to continue from where we have left off and/or to explore future developments on EPSS design/creation.*

## 2. Design Problem

This section of the paper presents a basic description of the IST doctoral qualifying exam process. It then discusses some basic features of EPSS. Finally it discusses the semester's design challenge<sup>1</sup>: to build an EPSS to support doctoral students preparing for the qualifying exams.

### 2.1 The Qualifying Exam Process

Qualifying examinations are an important milestone for doctoral students in almost any graduate program. In the IST program, doctoral students must pass a written qualifying exam as well as an oral qualifying exam before they are admitted as official doctoral candidates and allowed to proceed with their dissertations. Many students view preparing for the qualifying exams as a hurdle that they must get over before moving on to more meaningful research/work as a graduate student. It is a process, which traditionally causes a lot of stress for the individuals preparing for the exams.

Recently, in the IST department, the qualifying exam process changed. In the past, the qualifying exam was based on a closed book format. Over two four-hour sessions on consecutive days, the students had to answer a series of short essay questions with the purpose to be able to analyze and synthesize their knowledge of the field of instructional systems technology. The new process, called the "authentic Qualls" gives students a period of three weeks to write three documents on given topics. The documents are not

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<sup>1</sup> This is a one year on going project. Paper was written primarily based on the first version of EPSS we created.

essays but rather formats (such as grant proposals, journal articles, etc.) which resemble the types of writing that doctoral students will be engaged in as researchers.

## **2.2 Electronic Performance Support Systems**

While there is still some debate regarding the definition and function of electronic performance support systems (EPSS), the term generally refers to some type of electronic integrated system or infrastructure which provides access to information and tools which enable individuals to achieve a high level of performance. Gery (1991) explains that an EPSS is custom designed to provide access to information, learning activities, and expert consultations at the moment of need. Brown (1996) explains the role of an EPSS: “[An EPSS provides] a context within which work is done. Everything needed to do the job—information, software, expert advice and guidance, and learning experience—is integrated and minimal support and intervention by others.....” He adds that the concept of the EPSS is a shift away from viewing workers/performers as “people to be trained” to viewing workers as “people who need support on the job.” An EPSS concentrates on the performer, the job, and job tasks.

Corporations are benefiting from the implementation and usage of integrated electronic systems (Borwn, 1996; Raybould, 1995). For example, a large corporation may combine its many electronic tools (including databases, word processing, e-mail, calendars etc.) to facilitate easy access. This can increase the worker’s efficiency (Gery, 1991; Kavat, 1997; Raybould, 1995). In addition, an EPSS can also increase the efficiency and productivity of a worker by providing just-in-time coaching and tutorials that can reduce the learning curve and improve performance. For example, a manager needs to write a performance appraisal for an employee. An EPSS can provide this manager the employee’s profile and work performance, give the manager advice messages of how to review the employee’s performance, and provide a short learning module on how to write performance appraisals.

## **2.3 The Quals EPSS**

The design problem we were faced with was to design an EPSS that would support doctoral students in their preparation for taking the qualifying exams. Although EPSS development and use are more commonly found in the world of business, educators have begun to explore EPSS applications as well (Chiero, 1996). More recently, integrated electronic systems (EPSS) have been developed for use by teachers in grades K-12 (Kavat, 1997) as well as for special education teachers in behavior management (Hung, 1998). For example, an EPSS can provide assistance with the task of creating an individualized lesson plan for a student assessed with learning difficulties in a particular subject. An EPSS can help teachers establish, maintain, and facilitate an effective work environment by improving the performance of their daily tasks. Based on the success of this integrated model, this study is important in discovering the need and benefits of developing a similar system to help doctoral students improve the efficiency of their work/study performance.

We believe that using an EPSS design for the performance support of qualifying exam takers is a good match. The main characteristics of doctoral students’ work for Quals are to master the skills of developing their own ideas once they have located, organized, evaluated, and synthesized the existing literature. This is similar to the work in many large corporations and educational settings that have benefited from EPSSs in the past. Also the tasks/works that relate to Quals preparation involve vast amounts of knowledge, technology, and high performance expectations. These features are a few of the major reasons that Brown (1996) mentioned in outlining when an organization/institution should choose an EPSS solution.

## **3. Design Process**

### **3.1 Needs Analysis**

In order to design a product that will enable people to work efficiently, we must define and understand how they work and what they need to do their jobs, as well as the whole environment. We feel that conducting a complete and detailed analysis before we begin designing it is premature. The gradual determination of the finer details of analysis will emerge as the various levels of users interact with a demonstration prototype. At this stage, the focus of the analysis is to list the performed tasks, the process of detailing work flow, and the process and skills. The analysis techniques include interviews, observation, and document analysis.

### 3.1.1 Participants

We collected data from people who are involved in the quals process, including faculty members, the quals committee, the department chair, and doctoral students. Shown in table 1, the main characteristics of doctoral students that we considered based on the department profile are gender, marital status, work status, transfer students, and quals taken.

Table 1. Characteristics of Participant

Quals Taken		Transfer Student <sup>2</sup>		Work Status			Marriage Status		Gender	
Yes	No	Yes	No	P/T	F/T	None	M	S	M	F
6	7	8	5	12	1	0	6	7	6	7

### 3.1.2 Multiple-Perspective Analysis

During the process, detailed tasks, workflow, the process and skills were analyzed from socio-technical and user-centered design perspectives. We determined how each task component contributes to the product based on Carr's classification of tasks: accomplishments, ancillary activities, and distractions (1992.) This analysis helped us to derive efficiencies from electronic support. The efficiency is increased by removing distractions, and effectiveness is increased by supporting completion of necessary ancillary tasks and accomplishments.

## 4. Designing Principles and Rapid Prototyping

Major principles other than user-centered design principles for multi-media, computer system design, goal—to reduce stress, and change behavior pattern.

With the analysis framework and all the behavior patterns we found, 16 categories of needs were emerged. They are:

- Information
- Tools;
- Stress reduction
- Cooperation & collaboration
- Access to resources/information
- Suggestions and tips
- Writing strategies
- Clear expectations
- Language needs
- Physical organization readings
- Individual work
- Reading strategies
- Useful courses
- Time management
- Extenuating circumstances
- Location for study & writing

Then we created and designed “EPSS solutions” which are suggested for each “need” and would emerged in various levels in the system. Again, a socio-technical approach was applied through out the whole process. We discussed each item (task, process, need, and intervention. etc.) back and forth between micro-level and macro-level and among those perspectives and design guidelines we mentioned before. Figure 3 was part of the instrument that we used to facilitate our discussion. It shows a partial log of the discussion. The category of need could be checked for more than one socio-technical area: Work practice, people, environment technology.

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<sup>2</sup> Transfer student indicates the students who have been through the “core course” that is required in the first year of the IST master program.

Figure 3: Example of application of socio-technical principles to writing strategies

By identifying needs and coming out intervention within border pictures and among all possible interaction that we could think of, the major conceptual categories that we would like to support are:

- (a) information management
- (b) stress management
- (c) collaboration management;
- (d) productive through embedded guidance, advice, feedback and work metaphors; and
- (e) a problem-solving environment that integrates basic tools, information management, collaboration and productivity tools in a seamless environment.

Category: C2 Writing Strategies			
Work Practice	People	Environment	Technology
<b>X</b>			
EPSS Suggestions			
1. online debates around specific questions (KNOWLEDGE SHARING)			
2. connect to R711 area			
3. examples and tutorials for each of the writing formats (PERFORMANCE)			
4. collaboration with R711 – suggestion to take (KNOWLEDGE SHARING)			
5. reference books about how to improve writing. (INFORMATIONAL)			
6. contact information for writing labs (INFORMATIONAL)			

The EPSS included conceptual tools such as information managers, collaborative utilities, and guidance (including suggestions, advices, war stories, reflections) and support mechanisms that reflected or embodied “expert behaviors,” that we thought are keys that can lead to good performance in the qualifying exams and should be developed for the quals. They were identified from the interviews with those who had successfully passed the qualifying exams<sup>3</sup> and faculty members.

Building around a strong, meaningful metaphor is key in our design. We tried to incorporate a meaningful metaphor into EPSS to allow students envision the process at the early stage and to alleviate the stress that students felt during the preparation of the exams. Hoping this strategy has impact on their behavior, such as start early, clear vision, reduce stress,...etc.. We would like our potential users to actively participate and buy into the EPSS program.

## 5. EPSS Prototype and Knowledge Management

In this general overview section we explain several strategies that we tried to use the EPSS to address these issues. Some concepts learned from knowledge management literature that has been incorporated into the design will be discussed as well.

### 5.1 General Design Overview

Two of the main issues that we wanted to address with the Qualls EPSS are:

- reducing the stress involved in Qualls process
- making the Qualls preparation process more meaningful to the professional development of the students

*One thing that we wanted the EPSS to do was to be a catalyst for changing the way students perceived the Qualls process. We felt that it was important to help students get the bigger picture early on about how the qualifying exams fit into the whole doctoral program and their future professional development. We hope to help students perceive the qualifying exam process as a learning process that is just an extension of the other professional activities they are and will be involved in.*

#### 5.1.1 The Bigger Picture

<sup>3</sup> Mistakes made by all takers also played an important role to help us identify key behaviors.

In order to provide a general EPSS tool that would be useful to all students in the IST program, the Qualls EPSS was designed as a part of a larger EPSS. This EPSS would allow students to customize their profiles and include components such as the Qualls components if they so desired.

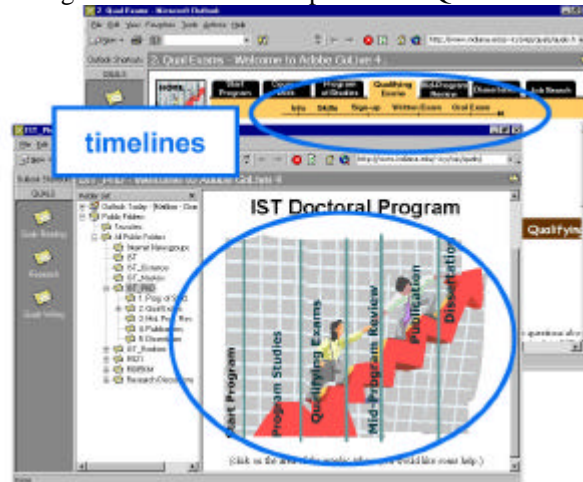
### 5.1.2 Timeline Metaphor

While the mockup in Figure 3 shows the top level view based on profiles, we also thought that the use of a timeline metaphor for the doctoral student profile would be useful. Figure 3 shows a screen shot of how this metaphor might be integrated into the EPSS.

The use of the timeline metaphor has several benefits that help us to reach the goals of the EPSS. Primarily, it helps to place the Qualls EPSS components into the larger framework of getting through the doctoral degree program. In the ideal situation, students would be able to easily navigate back and forth between the different EPSS components. Each “mini” EPSS would help support activities specific to different milestones in the doctoral student timeline.

Part of the impetus for using the timeline metaphor was also to expose incoming students early on in their program to information and tools related to the Qualls process. We feel that doing this is a step towards helping students to change their practices of preparing for Qualls a semester before.

Figure 3: Timeline Metaphor in the Qualls EPSS



Additionally, combining the components under a common metaphor allows for emphasis of skills and other commonalities between major doctoral program milestones.

Finally, within the Qualls EPSS components, we continue using the timeline metaphor. Figure 3 shows how the user interface emphasizes the steps that need to be taken in order to complete the qualifying exam process. Prominently featured in the design is the acquisition of skills.

### 5.1.3 Skills Development Orientation

Another goal of our design was to not only reduce the stress level of studying but to also make the Qualls process more meaningful to the doctoral students. The department has taken large strides in this direction by moving to the “authentic” Qualls format. We have tried to take it a step further by highlighting within the EPSS three specific skills that will help students to pass the qualifying exams. The skills are:

- Reading Skills
- Writing Skills
- Research Skills

Highlighting these three skills is key to the EPSS because these are the same skills that a student must acquire in order to publish, to get through the dissertation process, and to survive professionally.

## **5.2 Tacit vs. Explicit Knowledge Features**

Tacit knowledge includes ideas that are created in the mind of the individual. It also includes the “mental model” or a framework of how we see and perceive the world. Working mental models can include “schemas, paradigms, beliefs, and viewpoints” (Nonaka, 1994, p.16). Tacit knowledge is deeply rooted in the way we behave and think. As a result, an effort must be made to draw it out of individuals and make it available to others. Conversely, explicit knowledge refers to knowledge that is “transmittable in formal systematic language” (Nonaka, 1994, p.16). Hence explicit knowledge may be more readily available to others. We have tried to apply these principles of knowledge management into our design prototype.

### **5.2.1 Transferring Tacit Knowledge**

As knowledge is not static, but rather dynamic, Nonaka refers to several kinds of knowledge conversion: Tacit to tacit, Tacit to Explicit, Explicit to Explicit and Explicit to Tacit. Tacit to tacit knowledge creation (labeled socialization by Nonaka) creates types of knowledge such as embedded and encultured knowledge (Blackler) that tend to be found at more of an organizational level. These types of knowledge depend heavily on shared understandings to be created. They can also reside in systemic routines and cultures found within organizations (see Figure 6). We tried to incorporate encultured knowledge by providing scenarios where the user can read about or listen to the process of how one student explains to another what steps they took to prepare for the Qualls and what things they would have done differently. It is explained in terms of the IST culture and how work gets done in IST. The process of socialization is one that may be the most difficult to facilitate with an EPSS; we felt that the a system in which people with a shared goal of passing the qualifying exams can meet is one of the first steps to creating a community. We provided students a social space where students can learn in a collaborative effort. In each section of Reading, Writing and Research skills, students can discuss how they would like to share their exemplar pieces, or seek input from each other of how they would answer a question. In addition, there is a space for them to discuss personal issues such as coping with stress. It may be that just having the system in place will provide people with the opportunities to contact each other and begin the process of sharing and creating tacit knowledge. Tacit to explicit knowledge creation (labeled externalization by Nonaka) will most likely generate encoded knowledge (Blackler). Encoded knowledge is information that is conveyed through signs and symbols. This happens when individuals try to codify or physically represent some piece of knowledge. We found that the knowledge of how to successfully pass the qualifying exams were in the minds of the few. This was done by capturing war stories and documenting students who have taken the Qualls and share what they thought were good and bad practices.

### **5.2.2 Making Knowledge Explicit**

Explicit to explicit knowledge creation (labeled combination by Nonaka) represents an area where information processing can create new knowledge. New encoded knowledge can be created through this process as well as embrained knowledge. New embrained knowledge could be created as knowledge “that” and knowledge “about” expands due to transformations of explicit knowledge. Through the process of combination we tried to take explicit knowledge that already exists about the Qualls and process it into a form that is more conducive to individual knowledge acquisition. This was primarily done by having all the information about the Qualls, the reading list and being able to practice skills for the Qualls, all in one place. This also allows for group interactions in a discussion forum where ideas are discussed, transformed, and enriched.

Explicit to tacit knowledge creation (labeled internalization by Nonaka) represents what we most often consider to be traditional learning. This is where knowledge in explicit form (often times abstract knowledge) is made tacit by putting the abstract knowledge to use in a real-world situation or, in other words, learning through grounding the abstract in concrete situations. This move from explicit to tacit often times creates embodied knowledge or knowledge about “how” things are done or familiarity or acquaintance with a system. The process of converting explicit to tacit knowledge can also create new levels of embrained knowledge. The process of internalization was included into the design of the EPSS by providing ways for the students to convert their explicit knowledge into tacit knowledge. For example, there were tools to help students take a technical understanding of the writing formats and convert it into tacit knowledge through practice and comparison with exemplars.

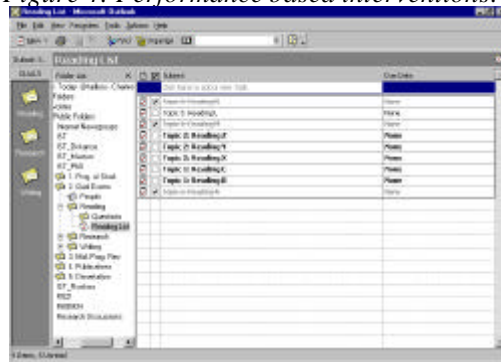
### 5.3 Quals EPSS as a Productivity Tool

One of the findings from our needs analysis was that doctoral students in general are juggling many different responsibilities and are very interested in improving the efficiency of their efforts especially when it comes to the qualifying exam preparation process. For this reason we believe that the functionality of our Quals EPSS is more heavily weighted towards the productivity end of the spectrum than towards the innovation end of the spectrum. Many of the features of the EPSS (such as sharing advice, war stories, etc.) are geared towards capturing innovative ideas from past Quals takers and making them available in an explicit way to current Quals takers. The idea is that we want the EPSS to improve the productivity of current Quals takers by making their studying efforts more efficient. Making appropriate information readily accessible to the Quals takers is also a way that the EPSS enhances the productivity of its users. A few types of information that are made accessible to the users are:

- Official Information
  - Policy statement
  - Writing formats
  - Ethical issues/ code of conduct
  - Grading rubrics
  - Reading List
- Library/Research Resources
  - Accessing databases (knowing which databases to go to)
  - Keyword / descriptors, related to IST – by topics
  - Using bibliographic info
  - Links to on-line full text / e-journals
  - Links and list of Core journals in the field
  - Basic search skills / strategies
- Bibliographic Info
  - Basics on ProCite and EndNotes
  - Writing format style guides (such as APA)

In addition to providing needed information to students, the EPSS design tried to also focus on creating performance interventions that would help to improve an individual's productivity. An example of one such intervention is providing each student with a checklist of the readings on the quals reading list. The student can then add readings to the list, set a reading schedule, and keep track of what he/she has read. Figure 4 shows a mock up of how an intervention such as this might look in the EPSS.

*Figure 4: Performance based interventions: Reading List Checklist*



### 5.4 Knowledge Management Objectives

Davenport (1998) detailed the four following knowledge management objectives:

- Creating Knowledge Repositories
- Improving Knowledge Access
- Enhancing the Knowledge Environment
- Managing Knowledge as an Asset



This section explains how specific features of our Qualls EPSS help to accomplish these different objectives.

### 5.4.1 Creating Knowledge Repositories

There are three main features in our design related to creating knowledge repositories: (1) providing static information, (2) providing dynamic (updateable information), and (3) creating meaningful categories for locating appropriate information.

#### 5.4.1.1 Providing Static Information

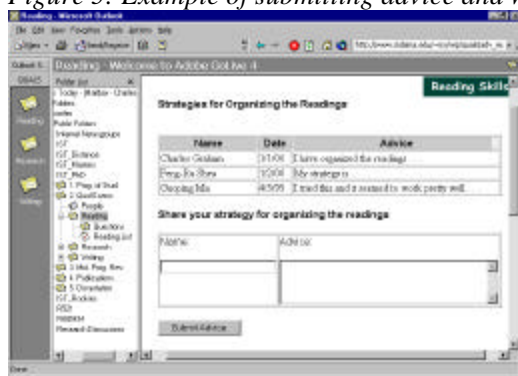
There are lots of specific pieces of static information that are provided through the Qualls EPSS. Section 4.3 of this report lists some of them in detail. Static information was typically provided as links to resources or official information. Figure 8 shows an example of a screen shot of a part of the EPSS where static information regarding official Qualls information is provided.

#### 5.4.1.2 Providing Dynamic (updateable) Information

There were many ways in which we tried to provide dynamic information to the EPSS user. One of these ways was to provide a space for individuals to post questions and get responses. For this we used the public folder feature of MS Outlook. The EPSS contains a separate folder for each of the main skill areas of reading, writing, and research. Each of these folders has a “Questions” sub-folder where students can post questions they have and get answers posted by other students or faculty members.

Additionally, the EPSS will have forms that allow students who have already taken the exams to submit advice and war stories to a database for students who will be taking the exams in the future (see Figure 5).

*Figure 5: Example of submitting advice and war stories*



Another dynamic feature of the EPSS will allow students to share information about bibliographic databases as well as the database files themselves. So a student who wishes to use EndNotes may get advice and give advice to others about how to use the tool. The EPSS will also allow individuals to share their EndNotes or ProCite database files with other students. So a student just starting the program could begin with an EndNotes database file that already has the qualifying exam readings in it.

#### 5.4.1.3 Meaningful Categories for locating information

A final area that is related to the EPSS providing knowledge repositories to the students is through its organization of the information into meaningful categories. A knowledge repository is not very useful if you cannot quickly find the information you want within it. In the EPSS we tried to simplify the interface by creating a timeline of tasks related to the Qualls and also focusing on skills acquisition (See Figure 11). We felt that most of the critical information fit nicely into these categories. In addition to providing a few

categories, a search capability is also planned for the EPSS, so that the entire EPSS database can be searched for key words.

#### **5.4.2 Improving Knowledge Access**

Finding ways to provide improved access to available knowledge was another focus of our design. The primary way we did this i was to provide a mechanism for the sharing of contact information among individuals who are taking the qualifying exams. Figure 12 shows an example of the contact list, which is updateable. Only students wishing to have their names included on the contact list would be listed there. In addition to regular contact information, the contact list gives information regarding when each individual plans to take the qualifying exams.

A few other ways in which access to information rather than the information itself is provided through the EPSS is via access to the Qualls preparation listserv, providing contact information for the writing labs, and through access to information and writing feedback available to the R711 students.

Finally, access is provided to library resources. However, we didn't want to just provide links to the main library resource page. So, under the "Research" area of the EPSS we provide access to the specific online journals that are related to our field. We also provide information regarding listings and call numbers for non-electronic journals related to IST as well as search terms related to the field and especially related to the reading categories.

#### **5.4.3 Enhancing the Knowledge Environment**

We attempt to enhance the knowledge environment by making it comfortable and useful for everyone that wishes to use it. We tried to do this by using the timeline metaphor that pervades the design prototype. We use this metaphor to try and subtly facilitate a behavior change. We hope that the timeline can serve as a friendly reminder to students of how their preparation fits into the larger picture.

We also attempt to enhance the KM environment by including a scenario in the EPSS. The purpose of the scenario is to get students thinking early on about the issues related to qualls and to get them motivated to start preparing for the qualls early. In a way we are using the scenario to try and increase "cultural receptivity" to the qualls preparation process.

We also believe that the knowledge environment is enhanced through the integration of important skills such as reading, writing, and research throughout the entire Qualls EPSS as well as the other EPSS components under the doctoral student profile in the IST EPSS. The knowledge environment is enhanced because familiar themes in the form of skills will surface no matter where the user is in the system.

#### **5.4.4 Managing Knowledge as an Asset**

Figuring out how to manage knowledge as an asset was one of the most difficult challenges of the EPSS. There are two main ways that we see the EPSS playing a role in managing knowledge as an asset.

- through acquisition of valuable skills
- through sharing of bibliographic database files – combining assets of individuals to make a larger whole.

Skills such as reading, writing, and research are certainly invaluable assets to any doctoral student. One's ability to adeptly perform tasks related to these three areas is certainly a form of "intellectual capital" belonging to the student. The EPSS helps students to acquire and enhance these skills.

Secondly, knowledge can be captured in bibliographic database files (with ProCite or EndNotes). This might include the bibliographic information as well as short summaries, key words, etc. Once this knowledge has been captured, the EPSS provides an easy way for students to manage and share this explicit knowledge as an asset.

### **6. Reflections**

As we reflect back on the process that we have gone through in rapid prototyping an EPSS to support doctoral students preparing to take the qualifying exams, we feel that we have learned a lot about EPSS design. In particular, both user-centered and socio-technical perspectives and knowledge management have impacted our design.

## **6.1 Underlying Psychology**

As we began to work on the EPSS using a socio-technical design framework, we really focused on the “work practices”, the process of work practice, and the interaction with environment, people and technology. We then tried to understand the underlying psychology behind why students do what they do in preparing for the qualifying exams. This focus helped us to identify the components of (1) stress and (2) desire for efficiency that seem to pervade most student’s approach to preparing for the qualifying exams. Once we understood this, we were able to develop the timeline metaphor for the EPSS. Also, it became one of the frame factors that helped us to focus many of the interventions within the EPSS towards skills development in the areas of reading, writing, and research.

## **6.2. Knowledge as Process vs. Knowledge as Object**

Another idea that impacted us was changing our conception of knowledge from only “knowledge as object” to also include “knowledge as process.” At the outset of the project, our group had the idea that an EPSS was primarily a “knowledge bank” or “knowledge repository” where knowledge objects were stored and retrieved at appropriate times. Fairly soon into the semester, we began to change our ideas as we were exposed to the concept of “knowledge as process.” This drastically changed how we viewed the EPSS. Instead of just looking for types of information that we could provide to individuals, we began to look at how our EPSS could actually act as a catalyst to change the way people prepared for the qualifying exams. This led us to try and develop and incorporate more performance-based interventions into our EPSS design.

## **7. Conclusion**

We applied a socio-technical design framework, user-centered perspective, and a rapid prototyping approach to the EPSS design. The design was developed by looking at the work practices and psychological behaviors of individuals currently preparing to take the qualifying exams as well as individuals who have already taken the qualifying exams. The EPSS is built upon the idea that knowledge can be treated both as “object” or “process” and thus incorporates both informational interventions as well as more performance-oriented interventions.

Two of the main (interrelated) goals of the EPSS design have been to (1) reduce the stress of those preparing for the qualifying exams and (2) to increase the efficiency with which the students can prepare for the exams. These goals are achieved, at least in part, by providing an environment which encourages students to begin preparing earlier than a semester before the quals by working to develop skills in the area of reading, writing, and research that will be useful throughout the program as well as in their professional activities. They are achieved by providing the environment that allows students to develop problem-solving skills in the areas of information management, stress management, collaboration management, and productivity improvement.

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# ADAPTING A MASTER'S COURSE TO THE WEB: PRINCIPLES, STRATEGIES AND RECOMMENDATIONS

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## Abstract

*The purpose of this paper is to describe the process of adaptation of R522: Instructional Design and Development, from a residential course to a web-based course offered in the Distance Masters program in Instructional Systems Technology at Indiana University. A description of the web-based course, factor impacting the adaption process, and recommendations for adapting a course to the web are also discussed.*

In Fall 2000, the Instructional Systems Technology department at Indiana University in Bloomington began offering its 36-hour Master's degree program at a distance. Half of the 17 students who enrolled in the program are from Indiana; the rest are from out of state, spanning three time zones. Just over half of the students are women; the group is evenly split among those who work in K-12, those in higher education, and those in the corporate field. The projected time to complete the program being 3 years, and during the first semester of the program, the students enrolled in four hours of coursework: R521: a one-hour orientation to the field, and R522: a three-hour course about basic instructional design and development.

R522: Instructional Design and Development is the first course the core set in the IST department. Students in the regular residential program come in as a group and go through a core set of courses; two in the Fall semester and two in the Spring. The other usual Fall course is R511: Instructional Technology Foundations I, an introduction to and history of the field. The students tend to take the core set together throughout the first year of the program, after which they have more traditional individual choice of courses for the rest of the program.

R522 is an in-depth explanation of instructional design; the students are introduced to the ADDIE model and instructional design theories, and also work on usability, formative evaluation, and visual design. The deliverables for the course include two projects; students develop materials to teach one concept and one procedure. Therefore, they become familiar with at least two different instructional design theories for each type of instruction, and follow the procedures for materials design and development for two projects.

The IST program focuses heavily on group work; students enter the program and immediately begin working very intensively with teams. The program is also project-based; students work in their teams on two large projects throughout the semester. We wanted to maintain this approach in the online Master's program; the ideas of intensive group work and thorough materials production at a distance were the first few challenges of designing this course. Our program also emphasizes reflective practice; students not only on look at their finished product, but are also required to reflect and write about the group process, group dynamics, team functioning, as well as on the instructional design process itself. Student write weekly e-mail updates throughout the semester, as well as a project report at the end that discusses the design process; there is as much emphasis on process as on product. Finally, we wanted to maintain a feeling of community among the students. As alluded to earlier, about 50 students, both masters- and doctoral-level, enter the program every fall. These students go through core together and really start to develop a sense of community; they feel like they're all going through boot camp together. This feeling of community and interdependence is another thing that we wanted to replicate in the Distance Master's program.

In the residential program, incoming students have a one-day orientation session the week before school starts. They meet each other and the faculty, have tours of the department and the School of Education, and have a general introduction to the program. They spend the next number of weeks getting to know each other in classes and in the social spaces in the building. The Distance Master's students would not have this latter opportunity, so we created a 4-day on-site orientation program for them. The week

before the beginning of the semester, all of the distance students came to Bloomington to engage in a variety of content-based, group-building, and administrative tasks. We wanted to instill a “boot camp” feel to the orientation to replicate what the residential students go through in their first few weeks of core. We decided that if we were serious about the community aspect of the program, we would have to emphasize it from the beginning, and that would include bringing students and faculty together face to face.

The problem that we were trying to address in designing a web-based version of R522 was how to create an online course that matches the residential experience in terms of assignments, criteria, the problem- and project-based nature of the program, the emphasis on teamwork and group-based interactivity, the implementation of reflective practice at several levels, and maintenance of a community of learners and cohort support.

The purpose of this presentation is to describe what we went through in the planning, development, and implementation of a flexible online course based on our principles, which we have taken to be learner-centered design, knowledge construction, active learning, collaboration, and multiplicity.

## **Lessons from the literature**

Learners thrive in learning communities. We know in the distance situation, students who are geographically remote from the instructor and other learners can feel a sense of isolation. One way of reducing the feelings of isolation is to know that you have a number of people you can count on and who are doing the same things and going through the same things on the other side of the country. Being part of a community reduces attrition. It is well-known that when people feel part of something, they are less likely to drop out because they know that someone else is depending on them. If a student is working on a group project, then suddenly decides she really doesn't feel like continuing with the program, what keeps her engaged is knowing that others are counting on her. The more that learners need each other, the better we are in terms of keeping them in the program (Palooff & Pratt, 1999; Raymond, 1999).

Learners in an online format need a great deal of curricular, instructional, and technological support (Sewart, 1993; Morgan & Tam, 1999). All of these are important in any course, and at a distance, their needs are magnified with regards to the technological support. A number of presentations at this conference were about a certain online course, but students came to campus anyway. This is not the case for us; since half our students are out of state, as far away as South Dakota and New York, coming to campus is not an option. If these people could come to Bloomington, they would enroll in the residential program. But they can't, which makes them extremely dependent on technological support. It is critical then, that these students be able to access to the kind of supports they need in order to achieve the goals of the course, whether those supports are library readings, grading rubrics for assignments, presentation materials, or technological tools.

Learners need frequent and meaningful interaction with the instructor. It also goes without saying that, in any course, learners seek interaction with the instructor. In a distance format, when students don't have the luxury of coming to class every week and seeing the instructor, they have to fulfill their interaction needs in other ways (Kirby, 1999; Crouch & Montecino, 1997). We remained cognizant of these differences and worked to build in other opportunities not only for learner-instructor interaction, but also for learner-learner interaction.

Activities should be task-based. Because students who take online programs are often working fulltime, perhaps even in the field, they tend to favor the practical over the theoretical. Therefore, the projects must be not only applicable, but authentic and meaningful as well. Evaluation therefore should be authentic and based on those tasks (Nelson, 1998).

Learners should be actively involved in the evaluation and improvement of the course (Cheung, 1998). Our students, being the first cohort to go through the program, know they are working with a double-edge sword. On the one hand, they have the opportunity to almost mold the class to their needs. On the other, they are working with a fledgling program that is still working out all its kinks. Later in this paper we will describe the dialogue we have with the students about course improvements.

The final major theme we found in the literature was that of faculty support. It is important to offer not only release time for teaching online – which is, in general, much more time-consuming than teaching in the regular classroom, especially in the case of a new class – but also provide remuneration for any course development the instructor is involved in. Just like students, faculty will need extensive technical support; professors who are not instructional designers can also benefit from instructional consulting help when working in the new format (Saba, 1999; Schifter, 2000).

## **Description of the web-based course**

There are three major components of the R522 course. First is a website which is a one-way communication vehicle in which the professor provides the students with a great deal of information about the logistics, the topics, and the requirements of the course. All of the instructor-produced content resides on the web site, including links to other resources and information about books and other references. The second part is an asynchronous discussion forum in which students engage in online synchronous and asynchronous conversation. They can work at a class level, posting messages of interest to all the students; they also have private team areas that are open only to team members and that other students and the instructor cannot view. In addition to posting and replying to messages, in any of these areas students can post URLs for others' reference and can upload documents, such as their project reports or the instructional materials they are creating. The final element in the course is an e-mail listserv through which the instructor can communicate with all students quickly. Because e-mail is a "push" medium (the message arrives in their inbox), it offers more immediacy than a "pull" option like the forum (where students have to go to a particular URL to read a message). Students can also communicate with the entire class via the listserv if they so desire, although thus far they have very rarely taken this opportunity. There have been four iterations of this web-site and forum to this point (the middle of the semester), so it truly is an on-going design process of design and development for the on-line resources of this course.

The website is one-way information from instructor to students. A "home" link introduces the IST program and the course, with each student's digital picture there to give a feeling of community, so that the first thing students see is their classmates as a reminder that they are part of the larger community. This function is helpful not only for the students, but also for the instructors and staff to remember the students they met at the orientation and to put a face to a name.

Also on the index page, the "contact information" link lists how to get in touch with the instructor, the two graduate assistants who deal primarily with technological support, the program coordinator, and department offices for program and future course questions.

The "syllabus" link provides students with everything they need to know about how the course is run, including the course philosophy and approach, objectives for the course, assignments, evaluation and grading. Demographic information provided includes class meeting times and e-mail office hours. Office hours have been set so that students know that, no matter when they send e-mails to the instructor, there are two times during the week when emails will be answered. This alleviates the concern that "I e-mailed her an hour ago, why hasn't she answered me yet?" Class meeting times (live chats) were established as a metaphor for a class meeting: getting to "see" everyone at the same time and having the instructor there in real time to answer questions in front of everyone and "asking in front of the whole class" rather than replicating private e-mail conversations with the professor. (The weekly chat is the only mechanism that combines the two elements of timeliness and publicness; if you post in the forum, you lose timeliness - if you send private e-mail, you lose the publicness.) Basically, the syllabus is the contract with the students for what they will complete in the course.

The "schedule" is the driving page of the website. This is where the students go in order to manage and work through the course. The schedule provides a weekly calendar of presentations, discussion topics, and the deliverables due for the week. Each "presentation" includes detailed information such as the objectives of the discussion, an overview of the key points of the discussion, additional resources they should read to become more familiar with the topic, and questions for reflection. The "deliverables" links take the students to assignment pages which specify the date due, the point value and percentage of grade, any instructions for completing the assignment, and evaluation criteria so that students know how the assignment will be graded.

Also on the index page, the students find links to a "resources" page that provides a list of all materials students need to complete the course. The "turn in your work" link takes the students to a password protected fileserver where they upload their completed assignments to the instructor, so that the instructor does not have to go search through the forum or to deal with e-mail attachments every time the students hand in assignments. The "gradebook" link is a feature provided through the University Information Technology Services and Bureau of Evaluative Studies and Testing (BEST). Here, the instructor can create a Microsoft Excel spreadsheet with students' grades and narrative comments, and then post those to a password protected fileserver from which students can access all their grades and comments. The index page also features links to an "evaluation" website which is also administered by BEST and where students complete midterm and final course evaluations. The index page also includes links to a site map, a "frequently asked questions" page, and the class Sitescape Forum.

The second technological element of the R522 course is the asynchronous discussion forum. The university has had a SiteScape Forum license for at least three years, and this software is used to create a virtual meeting space for the course, where learners can discuss issues related to the class with each other in both synchronous and asynchronous formats. The R522 class forum includes four distinct spaces: first, there is a weekly discussion topics space where students go to interact with the instructor and other students regarding topics such as analysis, design, development, usability testing, creating instructor materials, implementation, evaluation, visual design, web authoring, concept learning, procedure learning, group skills for instructional design, and being a reflective practitioner. A second space in the class forum is devoted to group dynamics, and students use this space to discuss the readings about group dynamics that are required for the course. Third, there is a general discussion area where students can talk about any topics or issues related to the course, but not specifically focused on weekly discussions or group dynamics. Finally, each student team has a private space which is password-protected space and where they can go to communicate, share documents and work on their project deliverables. There is one other SSF space that is, strictly speaking, at the program level, not the course level. The Core Café is a space dedicated entirely to social and non-R522 topics. At the orientation, the students were involved in designing a metaphor (a town) for this student-run space, and emphasized that it could be used for any non-R522 discussion. Students could post messages about their personal lives and jobs, could add links to personal and career-related web pages, could post hints for technical problems, etc. In the beginning there was a good level of activity in the Core Café; however, postings in the Core Café have dwindled to none. It is possible that once the students have a need to communicate as a class (i.e., not just on their project teams), about which other courses to take, etc., that discussion in the Core Café will pick up again. It is something that we are actively watching for research purposes.

The third technological element of the course is the class listserv, which is used primarily by the instructor to communicate public information that needs to go to all students at the same time. Because of the immediate nature of e-mail, the listserv is used for announcements that require a timeliness and priority that would be ill-served by posting in the SiteScape Forum. The listserv is used by the instructor to provide reminders of deliverables due, to make changes in weekly plans, to send out clarifications regarding criteria for assignments, etc.

## **Instructional design process for adapting the course**

### **Collaborators in course design**

Our design process was a collaborative effort with five stakeholders/groups. The client in this design project was the instructor of the course, who has a great deal of experience in instructional design and web development. Given this expertise, the client was able to provide both subject matter and technical expertise regarding the course design. The Director of the Distance Master's program was also a key stakeholder in the design process, as it was expected that the design of this course might serve as a template for future IST Distance Master's courses. The IST Department Chair was a third key stakeholder in the design process, concerned with administrative aspects of the course as well as the relationships between the Distance Master's course (R522), the Distance Master's program, the residential program and school requirements. The fourth stakeholder group, the course designers, consisted of a team of five advanced IST students, who worked either as instructional or interface designers for this project. These students were either enrolled in advanced design and development courses, or submitted the design of this course as a development project, which is required for completion of an IST degree. Finally, in addition to these key stakeholders, students who had previously taken R522 courses were also involved in this design project, providing valuable input regarding the instructional and interface designs for the course web-site.

### **Guiding principles for course design**

Four fundamental principles guided all aspects of design and development for the R522 course website and forum. The first principle was that the web-based course must be of comparably high quality to the residential course; it is not acceptable to have a "R522 light" for distance students – or to differentiate the quality of experience our students received in the course based on the course format. Secondly, the web-based course must serve as a model for future web-based courses to be taught in the IST Distance Master's program, which meant that the technologies used to support the course and the interfaces used to present course materials could not be so highly specialized that they would be difficult to replicate in other courses. Third, the development process used would have to foster faculty ownership and commitment to the web-based course and the Distance program because we believe that faculty involvement is critical to the overall success of the Distance Master's program. Finally, the design team proceeded from the assumption that an iterative model of design and development would be most appropriate for adapting the



R522 course from the residential program to the web, because the iterative approach would best allow designers to address the interactions between content presentation, instructional processes and interface elements, and to adjust the course design as appropriate.

### **Process of adaptation**

The following process was used to adapt the residential course to the web-based environment described above. First, the design team met with the instructor to confirm the goals and objectives of the course, and to make sure that the goals and objectives were similar to the residential course. Second, the instructor identified the major content components of the course and considered how these components would best fit in the web-based instructional environment (the major components of the course were the instructional design process, instructional theories and group dynamics and critical reflection regarding instructional design and teamwork). Having determined the major components of the course, the third step of adaptation was the establishment of an overall technology strategy for the course (at this point, the instructor and designers agreed on using web pages to provide instructional materials, using the SiteScape Forum to foster group interaction and team interaction, and using the listserv to communicate time-sensitive messages to the entire class). Having identified the course components and the technology strategy for the course, the design team worked with the instructor to design an interface that would best reflect the priorities of the course and emphasize the major course components. The interface design process involved the identification of specific web-pages and forum links that would be needed, as well as deciding which elements would be needed on each type of page. The result of this step was the development of templates for each element of instruction (templates for the schedule page, presentations pages, assignments pages, resources, pages, etc.). Once a list of components had been identified, the instructor and the interface design team undertook discussions regarding the relationships between the various web pages and forum spaces in order to determine the most appropriate navigation paths and navigation structure for the course website. With templates for specific web-pages and a navigation structure in place, the design team turned to the task of gathering the actual instructional materials from various subject-matter experts, textbooks, journals, web sites and personal experience to write the content for the presentations pages and to develop the other content materials that were needed for the web-based course, which was step six of the adaptation process. These content documents were produced in Microsoft Word 98 and saved in rich text format, so that they could more easily be imported to html editors and coded as html files, which was the next step of the adaptation process. After html files were created, the files were usability tested with several representatives of the target audience, identifying changes to be made and updating the pages based on target audience feedback. The web-site was then ready to be uploaded to the university file server where it was tested for functionality and compatibility. We learned that there were some compatibility issues between the Unix commands used by the university servers and the programming code used when creating html files with Microsoft's Frontpage web editor software, resulting in the need to re-code a number of html files. During the onsite orientation, we showed the students the course web-site and trained them in its use. At this time, students also received training on the basic features of the SiteScape Forum, the group editing features available in Microsoft Word, as well as basic skills of teamwork and group dynamics. We felt that the course design would not work if we did not train the students in how to implement the design; and for this reason, an orientation was designed not only to provide students with the skills and knowledge they would need to be successful in this program, but also to give them the tools and technologies that would support their skills and knowledge. Based on this orientation experience, students began immediately to provide comments and recommendations for improving the web design, so a mechanism was created to gather their input, and these inputs are used for periodic maintenance and upgrading of the course website. We are now engaged in ongoing monitoring of the university's technological capacity to make sure that we are continuing to provide our students with a course website that is most appropriate to the goals of instruction and best addresses students' needs given available technologies.

### **Factors impacting the adaptation process**

Given the design process that has been outlined above, the purpose of this section is to discuss some issues that have probably impacted our development process, which would need to be taken into account by others who are planning to adapt a residential course to the web environment.

#### **Instructor experience and openness to innovation**

First, the instructor's background and experience with instructional design and with technology impacts how easy or how difficult it would be for a team of designers to come in and work to create a product quickly. In our case, the instructor was a designer and an experienced computer user, so she had a

very good grasp of both the process and the product she wanted. Working with someone who had varying degrees of experience in pedagogical strategies, instructional design, and communications technology would require different things of the design team and would yield very different results.

It is doubtful that an instructor would be willing to teach a web-based course if that person were not in some way open to innovation, yet instructor willingness often has little to do with what they end up teaching. The degree of an instructor's openness, willingness to risk, and acceptance of ambiguity will very likely have an impact upon how successful a web-based course may be.

#### **Technological capacity and infrastructure**

With the development of each course, there is a struggle to balance the competing issues of what technologies will be supported by the university, what is the greatest level of functionality that can be offered, what is the lowest common denominator of student technology that must be considered, and what technologies will be most easily accessible and cost efficient for students.

#### **Rationale for adaptation to web-based instruction**

For an IST department, the creation of a web-based program works not only at offering our program to those who cannot come to Bloomington, but also allows us to practice what we preach. In the tradition of the old lab schools, it gives us an opportunity to implement our ideas, to see if what we are reading, teaching, and proposing for others really does work, and what the issues are. It gives our students an opportunity to be involved in the design, development, and maintenance of a program before they go out into the world to create their own. The reasoning behind the creation of web-based instruction is likely to impact the design emphasis, as well as the time that can be dedicated to the adaptation process. If we didn't have students pushing us for this type of experience and needing to have this type of experience, we may not have been so quick to create the Distance Master's program.

#### **Fit of course goals with technological capacity**

Another factor that impacts the adaptation process is the fit of course goals with technological capacity. How much of a project-focus, readings focus, team-based focus, and individual focus there is in a course will determine what type of web-based design is needed. For example, all of the instruction and interaction in R522 is text-based. In the Spring, we will offer R541, a production course in which students do individual projects in Director, a web page, an audio presentation, and video presentation. The content of that course will greatly increase the technological needs and will require different tools and ways of working.

#### **Labor force available for course adaptation**

The instructor of this course could not have created the course materials alone. Fortunately we had graduate students who needed and wanted this experience and who were willing to work for course credit or to complete a required development project – if we hadn't had that labor force, it would have been all but impossible to get this material developed in the six-week time frame during which it was completed. The make-up of your labor force may differ: you may need to do much of the instructional design on your own and delegate the web development to others. Your time-frame may permit a few people to work more slowly on the development.

#### **Technological equipment and sophistication of learners**

As the faculty member teaching this course, one of the things that I'm most appreciative of is that the program development team created a set of minimum technology standards for the students, and told prospective students that they could not enroll in the program if they didn't have technology that met these basic specifications such as processor speed and modem speed and number of phone lines. We designed with a certain expectation in mind, and even then, we have made changes to make sure that we addressing the lowest common denominator of technology sophistication so that we aren't leaving any of our students behind. Nonetheless, we think it is not a burden to require that Distance students have more sophisticated computer equipment and connectivity capacities than residential students.

#### **Learner motivation for taking the course**

We have been trying diligently in the design to create an environment in which students really want to collaborate with team members, and to be engaged in community. We continue to think in terms of the design about how best to address community. The challenge with this type of program is to learn how to balance the interests of independent, self-motivated learners with the need to build professional community, to match those interests with the goals and purposes of the program, and to try to design a course website that links the goals of the learners with the goals of the course.

#### **Administrative support**

We have two graduate assistants who are full-time technology support for the course website, and this frees up the instructor to spend time addressing the curricular and instructional issues related to the

course. Without this administrative support, it is highly likely that most of the instructor's time would be spent doing trouble-shooting and problem solving with respect to technology. An example of the type of things the graduate assistants address include whether chat programs should be used for team collaboration, which chat programs work best, and dealing with the times that university servers go down and students can't access forums or the class web-site.

### **Tuition and fees**

There is an outstanding question as to whether the return on investment outweighs the costs of creating and implementing web-based courses. The need to generate revenue from a Distance Master's program, at some point, will become a factor that impacts the design and adaptation of residential courses to the web environment. The fact that our department is committed to this program in order to provide instructional design, development and research opportunities for our students means that this Distance Master's course and the program as a whole have an entirely different impact on our department than would be the case if the primary concern of our department was to generate revenue from this program.

## **Recommendations**

### **Start development early**

The initial development of the course described in this paper occurred over a six-week period from July to August 2000, and required approximately 500 hours of labor from a development team of five individuals and the instructor of the course. Obviously, the more people you have available and the more time you have, the better. Although the course development took only six weeks, the administrative and department-level foundation had been laid over the previous 6-12 months. Even if you do not begin designing right away, you need to start talking to the stakeholders, setting out requirements, getting faculty, staff and administrative buy-in, and dealing with bigger-picture issues.

### **Confirm capacity of technology to address needs**

Confirm capacity of technology to address needs. Does the university provide the technological tools, software programs, and administrative support that will be needed to create a successful distance learning experience? Make sure that the programs and software you choose are appropriate for the delivery mechanisms, for your students, and for your content. While not asking for new equipment and software costing thousands of dollars, require a solid minimum set of technology standards that your students will meet. Provide faculty with the best equipment and connection possible, from the office and from home.

### **Develop policies for ownership of materials**

There is much discussion of who owns what in the creation of online courses. Each university has its own policy. Make sure you are familiar with yours and that your faculty agree to abide by its terms. These policies can act as disincentives for faculty to create excellent online instructional materials, so communicate with administration about potentially updating and modifying policies that are too restrictive or that flout general intellectual property rules.

### **Have minimum technology standards for students**

As was previously mentioned, learning at a distance requires certain tools that are different from those a regular student may need. Stating explicitly what students will require is useful in that students can compare their present capabilities to the minimum standards and have good guidelines on upgrading. Additionally, if they want to buy a new computer, they have the standards at hand. Our university, like many others, has special hardware and software deals with a variety of companies that the Distance students can take advantage of. In our team-based program, if one student cannot connect or complete the work because he doesn't have the software, it is not just his problem, it is his team's problem, and therefore the class's problem.

### **Provide detailed technology training for learners**

Residential students and faculty have enough problems with getting their technology to work smoothly. Students learning at a distance are exponentially challenged to learn and troubleshoot their technology problems. In the residential IST program, students with questions can easily find someone in the lab or in the hallway to help them. The Distance learners may have no one within 500 miles who is working with this software and therefore must rely only on himself and the available resources. To this end, we not only gave students a crash course in much of the software and tools they would be using, but also taught them how to trouble shoot and where to go for help. There is a telephone help desk that they have access to, as well as Indiana University's Knowledge Base, an award-winning technology information database.

**Provide learners with guidelines for when to use each communication vehicle**

We offered very little guidance about which tools were best suited, according to our research, for what kinds of communication. Some of our teams did everything from team meetings to actual writing and development, completely synchronously, which ended up being long chat sessions that were useless to them later, and \$100 conference call phone bills. This is not surprising that students will take a while to figure out the best methods for communicating in the new way. Because students are used to meeting face-to-face and talking, they assume that the chat format works for every kind of interaction. In the future, we will offer students guidelines of when to use the Forum, when to use chat, when to use e-mail, etc.

**Test-adapt-test-adapt-test-adapt**

It is highly unlikely that the first version of the course website created will be the best or most effective one, so you should plan for and engage in at least several iterations of usability testing with representatives of the target audience, and use the results of those tests to adapt the website in order to improve the educational experience for the learners.

**Recognize that all faculty are impacted by the implementation of a single course**

One faculty member in isolation will not be able to design, develop or implement a web-based course. It takes the support of an entire faculty to complete this process. Additionally, the department as a whole needs to have buy-in to the process and the product. If there are faculty members who see the online version of the program as being watered-down and therefore less valid than a “regular” degree, these concerns need to be addressed. Chances are good that during the development and first implementation of online courses, the lead faculty member will have to lessen her other departmental responsibilities, and the other faculty members have to be willing and able to pick up that slack. Although some faculty may never teach in the online format, they may be asked to “guest lecture” or find other ways to interact with the Distance students. Even if they have absolutely no contact with the online program, their lives and jobs will be affected by the program and therefore they are important stakeholders in the process.

**Conclusion**

The process of adapting a residential course in Instructional Systems Technology to a web-based course for a distance masters program has been a challenging, and at times, a difficult experience. This process of adaptation has required that the instructor and the instructional design team grapple with issues of technology support, software capabilities, the collection and dissemination of course resources, the technological skills of learners and faculty, and the motivation of learners and faculty to create and sustain community. It has required that the instructor move out of the comfort zone of familiarity with the residential learning environment to consider what aspects of that environment are most appropriate and can best be replicated in an on-line environment, and what unique features of the on-line environment can facilitate learning.

Each adaptation of a residential course to a web-based environment will be in many ways unique and non-generalizable, as is the case of adaptation for the R522 course which has been described here. Yet, consideration of the experiences of this instructor and instructional design team may offer some insight to those who are in the process of adapting other courses to web environments of issues that impact adaptation, including course objectives, technological capacity, and learner skills and knowledge related to the use of sophisticated technology.

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# HUMAN-CENTERED DESIGN BILL OF RIGHTS FOR EDUCATORS

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It appears to be a ceaseless question on determining the best ways to incorporate technology within public schools. Though the past relationship between the Instructional Technology discipline and public schools has been tenuous and limited (Heinich, 1995), Willis, Thompson, and Sadara (1999) recently present encouraging news. They summarize the current research of a new sub-discipline within instructional technology: information technology and teacher education. This new field offers effective solutions to encourage technology adoption and integration within public schools. This article presents another potential solution by proposing a human-centered technology bill of rights for educators. The intention of this bill of rights is to influence educators' beliefs towards technology and to enable educators to confront the seemingly mesmerizing host of new technologies with confidence.

## Instructional technology in the schools: Allegiance and resistance

Throughout the last century, public support for the use of new technologies in the classroom has been sympathetic and promising. New technological gadgets (e.g., Edison's kinetographs, instructional television, filmstrips, videocassettes, and now, DVD players, etc.) have been designated as "champions" that will help facilitate the ultimate technology integration and revolution in schools. The general public tend to view technology as being "positive" overall (Kerr, 1996). This allegiance appears to be somewhat of a blind frenzy where there is an "initial wave of enthusiasm for new technology" (Cuban, 1986, p. 4). In fact, Segal (1996) describes this phenomenon as "technological utopianism" whereas Mellon (1999) characterizes the current allegiance to technology as a worshipping act.

However, the "Field of Dreams" syndrome<sup>4</sup> does not apply to educational settings. Even though new technologies are proclaimed, introduced, purchased and adopted by schools, teachers are resistant to "modern" technologies and are reluctant to accept new technologies (Cuban, 1986, p. 2). In most cases, technology is "hurled" at teachers when "non-teachers" introduce and originate new technologies into schools through top-down mandates (Cuban, 1986, p. 54). This is currently the case. Public schools are well equipped with computers, but all too often teachers do not regularly use this technology in their classrooms (Cuban, 1993; Office of Technology Assessment, 1995). Though Becker (1998) reports promising news for Internet use among teachers, universal acceptance of new technologies among teachers should not be taken for granted.

## Immature and mature views of technology

Despite this initial enthusiasm, reluctance, and resistance, individual teachers have successfully adopted and integrated technologies within their classrooms. However, there have been inconsistent technology adoption styles and usage among teachers (Dexter, Anderson, and Becker, 1999, p. 221; Office of Technology Assessment, 1995). These different styles can be categorized as an *immature* view of technology as opposed to a *mature* view. An immature view perceives new technology as an add-on or supplemental activity and develops routine instructional tasks (Willis & Mehlinger, 1996, p. 984). With a top-down approach, Fabry and Higgs (1997, p. 389) report that new technologies have been forced into schools which "typically results in superficial adoption rather than incorporating the substance." Ely (1997) comments that new technologies (e.g., computers) "rarely supplant other media and methods" (p. 104). A mature viewpoint of technology goes beyond this superficiality and views a particular technology as a tool to facilitate learning (Office of Technology Assessment, 1995). Thus, this new technology is not supplementing a particular curriculum, but is in the process of revolutionizing that curriculum. In fact, Ertmer (1999, p. 47) states "in general, the more integrated one's technology use becomes the more fundamental the required changes."

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<sup>4</sup> "Field of Dreams" refers to the film with Kevin Costner. In this film, Costner's character builds a baseball park in a corn field with the expectation that people will come once the field is built.

Still, whether a school adopts an immature or mature perspective of technology, the critical variable in the adoption and subsequent integration of a particular technology is the teacher (Fabry & Higgs, 1997; Saye, 1998). Teachers must be convinced of the feasibility of using a particular technology before this adoption and integration occurs (Office of Technology Assessment, 1995, p. 71). Teachers must perceive any possible change (technological or non-technological) as being helpful to their current duties (Saye, 1998, p. 211). Ertmer, Addison, Lane, Ross, & Woods (1999, p. 55) concur by stating, "if the computers do not teach what the teacher stresses, teaches things the teacher does not, or requires types of intelligent activity the teacher does not emphasize, it is unlikely the teacher will assign high value to its use." Quite possibly, teacher's resistance and an immature perspective towards technology could be solely dependent on teacher's acceptance. Top-down mandates will not bring about a fully technology-rich curriculum, but only teacher's individual decision and acceptance of a new technology will be the guiding force.

If it is true what Willis and Mehlinger (1996, p. 978) state as an "universal conclusion that teacher education, particularly pre-service is not preparing educators to work in a technology-enriched classroom," then we need to create the environment in which teachers can make rational decisions and accept a particular technology. In fact, Willis (1993) notes that we have moved into a new era of educational computing and a new way of asking questions about technology adoption (p. 14). We must now start asking questions about the new roles and responsibilities of a teacher and provide training to support teacher technology adoption and integration (Willis, 1993, p. 28). Fabry and Higgs (1997) note that in order to adopt a mature view of technology teachers "must also fundamentally change how they teach." (p. 388).

I take an optimistic stance and believe that we can provide an environment in which teachers can individually accept and maturely integrate technologies into their curriculums. In order to facilitate this interaction, I propose a technology bill of rights that is aimed at influencing teachers' belief system. Before this bill of rights and its principles are explicated, a summary of factors that influence and impede technology adoption, as well as a distinction between Ertmer's (1999) first- and second-order barriers must occur.

### **Incentives and obstacles for integrating technology**

Fortunately, past research has detailed numerous incentives and obstacles towards adopting and integrating technology within schools. Table 1 summarizes these factors. Some obvious influences include tangible factors, such as additional resources, financial support, staff development, etc. Teachers need to be convinced that a particular technology will solve their problems through practical means (Cuban, 1986, p. 66). In addition to these alterations, tacit improvements need to be implemented to promote the adoption of new technologies. Some of these proposed improvements include, promoting teacher empowerment (Topp, Mortenson, & Grandgenett, 1995, p. 11); providing a comfortable atmosphere and individualized attention (Schrum & Fitzgerald, 1996); creating a comfort zone (Norum, 1997) and other similar factors. Though it may be difficult to develop a "comfort zone" for teachers using technology, these tacit changes may be more significant than providing additional resources or offering staff development technology courses. Fullan and Stiegelbauer (1991, p. 315) note that "nothing has promised so much and has been so frustratingly wasteful as the thousands of workshops and conferences that led to no significant change in practice when the teachers return to their classrooms." Fundamental technological changes could be directly linked to these tacit stimuli.

Table 1  
Incentives and obstacles affecting technology adoption and integration

Incentives	Obstacles
<ul style="list-style-type: none"> <li>• Adequate equipment and resources (Becker, 1994; Fabry &amp; Higgs, 1997; Hadley &amp; Sheingold, 1993; Office Of Technology Assessment, 1995; Topp, Mortenson, &amp; Grandgenett, 1995)</li> <li>• Supportive environment that allows “risk taking” (Becker, 1994; Topp, Mortenson, &amp; Grandgenett, 1995, p. 12; Willis, 1993)</li> <li>• “Expectations and encouragement are vital to the infusion of technology into the educational process” (Topp, Mortenson, &amp; Grandgenett, 1995, p. 13)</li> <li>• Collegiality among users (e.g., teachers) (Becker, 1994)</li> <li>• Smaller class sizes (Becker, 1994)</li> <li>• “Exemplary teachers were in schools that had nearly twice as many computer- using teachers (Becker, 1994, p. 303)</li> <li>• Personal interest (Becker, 1994; Ertmer, et. al. (1999)</li> <li>• Extra time (Fabry &amp; Higgs, 1997; Hadley &amp; Sheingold, 1993; Office Of Technology Assessment, 1995; Schrum &amp; Fitzgerald, 1996; Willis, 1993)</li> <li>• Staff development (Becker, 1994; Fabry &amp; Higgs, 1997; Office Of Technology Assessment, 1995; Willis, 1993)</li> <li>• “Exemplary teachers simply had higher standards and greater perceived needs than did the other computer users.” (Becker, 1994, p. 315)</li> <li>• Attempt to reach students with learning or attention problems (Ertmer, et. al., 1999)</li> <li>• Motivated to make lessons more interesting (Ertmer, et. al., 1999)</li> <li>• Preparing students for the future. (Ertmer, et. al., 1999)</li> <li>• Staff support (Becker, 1994; Office Of Technology Assessment, 1995)</li> <li>• Teachers must be empowered to make decisions about technology (Fabry &amp; Higgs, 1997, p. 390)</li> <li>• “Ownership is critical to success.” (Willis, 1993, p. 29)</li> <li>• “Follow up support and coaching is as essential to effective staff development as is the initial learning experience.” (Office Of Technology Assessment, 1995, P. 30)</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of technology skills and knowledge (Martinez &amp; Woods, 1995)</li> <li>• Lack of equipment (Ertmer, et. al., 1999)</li> <li>• Mismatch with classroom style (Ertmer, et. al., 1999)</li> <li>• Lack of staff development (Ertmer, et al., 1999; Fabry &amp; Higgs, 1997; Office Of Technology Assessment, 1995; Topp, Mortenson, &amp; Grandgenett, 1995)</li> <li>• Absence of incentive or improper incentives (Martinez &amp; Woods, 1995)</li> <li>• Absence of environmental support (Martinez &amp; Woods, 1995)</li> <li>• Lack of motivation (Martinez &amp; Woods, 1995)</li> <li>• Lack of equipment (Ertmer, et al., 1999)</li> <li>• Lack of time (Ertmer, et al., 1999; Office Of Technology Assessment, 1995)</li> <li>• Lack of relevance (Ertmer, et al., 1999)</li> <li>• Lack of confidence (Ertmer, et al., 1999)</li> <li>• Lack of funding (Fabry &amp; Higgs, 1997; Office Of Technology Assessment, 1995)</li> <li>• Lack of access (Fabry &amp; Higgs, 1997; Office Of Technology Assessment, 1995)</li> <li>• “Innate dislike for change (especially change mandated from above) is the most basic and significant barrier to technology integration” (Fabry &amp; Higgs, 1997, p. 388)</li> <li>• “Top down projects tend to fail over time.” (Willis, 1993, p. 29)</li> <li>• Current assessment practices (Office Of Technology Assessment, 1995)</li> </ul>

Peggy Ertmer (Ertmer, 1999; Ertmer, et. al. 1999) distinguishes between these two factors as being first-order barriers and second-order barriers to technology. First-order barriers are external to the



particular environment, such as securing additional resources to learn more about a new technology. Second-order barriers are internal to the school setting and are related to one's beliefs about the use of technology. Second-order barriers "confront fundamental beliefs about current practice, thus leading to new goals, structures or roles" (Ertmer, 1999, p. 48). Ertmer notes that both of these barriers are prevalent in the challenges of technology adoption and both types of barriers need to be confronted simultaneously during the adoption process (Ertmer, 1999; Ertmer, et. al., 1999, p. 70). There is a distinct interplay between these first-order and second-order barriers. Ertmer, et al. (1999, p. 55) note that "researchers have suggested that teachers' beliefs about the role of technology in the classroom may either reduce or magnify the effects of first-order barriers" and that "second-order barriers may persist even when first-order barriers are removed" (p. 70). These intrinsic barriers towards technology are indefatigable since teachers' fundamental beliefs towards technology are more difficult to modify. However, the proper removal of these second-order barriers can be a critical variable in effective technology adoption. This elusive second-order barrier challenges the assumption that if a school provides enough tangible resources (e.g., money, computers, software, etc.), then teachers will be willing to use new technologies. This is not the case. Teachers' personal beliefs about using technology will greatly influence the use of a particular technology. Ertmer (1999, p. 51) notes that "reduction or elimination of first-order barriers allowed second-order barriers or issues to surface." The Office of Technology Assessment also notes that "many technology rich sites continue to struggle with how to integrate technology into the curriculum" (Office Of Technology Assessment, 1995, p. 30). Concentrating on shaping teachers' beliefs about using technology and removing these second-order beliefs is a critical variable during technology adoption and integration process.

## **Beliefs about technology and its impact**

In fact, attitudes and beliefs in teaching are essential in understanding how a teacher teaches, thinks, and learns (Richardson, 1996 p. 102). Richardson (1996) states that teachers' beliefs are influenced by personal experience, experience with schooling and instruction, and experience with formal knowledge. Like technology barriers and influences in schools, teachers' beliefs and attitudes towards technology also have been documented in past studies. Several researchers note that teachers feel uncomfortable learning new technologies (e.g., Brush, 1998, p. 243; Ertmer, 1999, p. 48; Fabry & Higgs, 1997, p. 389; Schrum, 1999, p. 85). Willis (1993, p. 28) notes that "many educators feel isolated and alone" with the process of learning new technologies. Both Carr-Chellman and Dyer (2000) and Laffey and Musser (1998) found that pre-service teachers viewed new technologies as an impediment or contradictory to effectively teaching their students. Saye (1998) offers a typology of teachers' beliefs towards technology. Saye developed a continuum of two types of beliefs: accidental tourists and voyageurs. Accidental tourists seek to control and adapt technology within their existing teaching structure while voyageurs seek to use technology for a personal challenge and willing to explore and experiment with technology (Saye, 1998, p. 224). Saye (1998) found that most teachers were accidental tourists and tended to stay within their own teaching style.

Teachers' attitudes towards technology use potentially present a formidable obstacle. These beliefs impede viewing technology as a tool and promote an *immature* view about technology. That is to say, if a teacher feels apprehensive about using technology and views it as an impediment to interacting with students, it is no wonder that technology is being used exclusively as a supplement and within the teacher's existing teaching style. Alternatively, successful integration of technology changes educators' view of the teacher-student relationship and alters their teaching practices (Dwyer, 1996). Becker (1998) found that teachers who purported to have a constructivist teaching style, tended to integrate technology within their classroom. Teachers' willingness to change is a key variable in successful technology integration (Marcinkiewicz, 1994). Though both Becker (1994, p. 291) and Schrum (1999, p. 86) agree that with experience, teachers may eventually become comfortable with a particular technology, there is a missing, critical link in interacting with technology. This variable is teachers' vision about how technology should be utilized in their classrooms.

Cultivating a positive vision towards technology can be a significant factor in promoting a *mature* view of technology and viewing technology as a tool (Ertmer, 1999; Office Of Technology Assessment, 1995). Ertmer (1999, p. 54) states that "one of the important steps in achieving meaningful technology use is the development of a vision of how to use technology to achieve important educational goals." Ertmer (1999, p. 54) recommends three strategies to develop a vision, including modeling, reflection and

collaboration. In addition to these strategies, we need to go a step further by adopting a set of beliefs and fundamental principles. We can “jumpstart” teachers’ positive experiences with technology by proposing a vision, a set of beliefs, and fundamental principles on the use of technology in the classroom. I attempt to encompass these values by proposing a technology bill of rights of educators. Exercising this bill of rights, teachers will become comfortable using technology, adopt a *mature* view of technology and start using technology as a tool in their classrooms.

## Technology bill of rights for educators: Human-centered design influences

Summarized in Table 2, this proposed technology bill of rights for educators is directed towards teachers’ use of technology and is intended to be a vehicle to change their existing beliefs (Ertmer’s second-order barriers). A brief description of the primary influences of this proposal will be discussed before each of these rights is explicated. Human-centered design principles primarily espoused by Donald Norman (1988, 1993, 1998) is the main philosophy that influences this bill of rights. This human-centered stance proposes an attitudinal shift from a reactive stance to a more proactive stance towards using technology in the classroom. It requires designers of new technologies to consider the needs of their users as a primary factor in their creation. With this newly adopted human-centered attitude, teachers will more readily integrate “new” technologies, as well as “old” technologies into their teaching practices.

The term, “human-centered” is synonymous with terms such as “user-centered,” “learner-centered.” Essentially, all of these terms reflect the belief that designers must create products based upon that teachers can use and are upon their users’ (or alternatively upon their learners’ or human’s) perspective. Software designers in particular have used this design philosophy and methodology as early as the 1970’s (Eason, 1988). Donald Norman (1988, 1993, 1998) who originally coined the term, *human-centered design*, describes this methodology as a “process of product development that starts with users and their needs rather than with technology. The goal of product development is a technology that serves the user, where the technology fits the task and the complexity is that of the task not of the tool” (p. 185).

This philosophy assumes and acknowledges that there are obstacles to effective technology use. To remove these obstacles, designers can improve their technological products based upon their users’ perspectives. To accomplish this, designers seek actual users react to initial prototypes in a lab setting. Designers then interpret these reactions

Table 2

Proposed human-centered technology bill of rights for educators

- 
- It is not your fault, it is the designers’ fault.
  - “Old” technology is fine to use as long it is effective.
  - Technology will *conform* to my proposed needs, not designer’s needs.
  - I am a designer of technology, rather than a user of technology.
  - Appropriate technology is redundant or impractical technology is an oxymoron.
  - The *sole* purpose of technology is to help me be more creative.
  - It is fine to make “errors” with technology; technology will adapt to my mistakes.
  - Technology is designed and used to solve *my* problems.
  - The more active technology user I am, the more effective the technology will be.
- 

and redesign their prototypes to better accommodate their users’ needs. Human-centered designers are encouraged to “test early and often” (Nielsen, 1993).

Similar to Tripp and Bichelmeyer’s (1990) rapid prototyping process, designers potentially could go through several iterations in gaining information about their users’ perspectives. Eventually, designers will create an effective final product.

There are several assumptions about designers and users related to this design philosophy. One is that designers are serving users and their needs. Users are more proactive whereas designers need to be reactive to their users’ requirements. Technology is expected to work effectively for its users and be

intuitive. If a particular technology does not work or is counter-intuitive, then it needs to be changed. The users do not need to be changed. Early participation from actual users is encouraged and promoted. Detected errors in early prototyping sessions are positive whereas early prototyping sessions that do not yield problems are suspect.

## **Proposed human-centered technology bill of rights**

This bill of rights is written specifically for teachers and administrators to improve their attitude towards the use of new technologies. This transformation will lead these educators to successfully integrate these technologies in their curriculums and future classrooms. These nine rights are described below.

*It is not your fault, it is the designers' fault:* This principle addresses the “blame syndrome” in which educators and other users usually blame themselves if they cannot successfully operate a particular technology. For example, students in my online *Introduction to the Internet* course often apologize for not performing a particular task, such as properly uploading their web pages to a server. They tend to accept the blame for not being successful in this process. From a human-centered design perspective, this belief is fallacious. If a user cannot navigate properly through a particular technology, then part of (if not all) responsibility lies with the designer. Too often, educators blame themselves for doing something “wrong” with technology. They might have pushed the “wrong” button, typed in the “wrong” command, or clicked the “wrong” icon. This error points to the fact that the particular designer did not originally anticipate how we would use it. We were not “wrong”, but our mental models (Johnson-Laird, 1983; Norman, 1986) of this process did not correspond to the designer’s own mental model. Since we did not originally conceive of the particular technology, incongruent mental models are not our responsibility. It is true that educators need to learn how to use particular technologies (e.g., word processors) through proper training (e.g., books, workshops, etc.) and designers are not responsible for this instruction. However, if teachers cannot utilize a particular technology properly, then designers must accept this responsibility and redesign the next version to better fit their target audience’s mental model.

*“Old” technology is fine to use, as long it is effective.* Too often, an erroneous belief is that the latest version of a software program or another technology is universally preferable to an older version or an older technology. But, this is not always the case. Sometimes an older technology (e.g., a chalkboard) may be more effective than its more recent counterpart (e.g., PowerPoint). If a teacher can teach an effective lesson using “old” technology (e.g., overhead projectors, chalkboard, slide projectors, etc.) then, it is acceptable to use. Why? Blindly jumping on the bandwagon to use the latest technology, especially if it is costly and potentially ineffective makes no sense.

This is especially true in the case of a high school in the southeast region of the United States. Recently, two high schools merged into one unified high school. This new high school was technologically upgraded with new computers and related equipment. Teachers in both schools were told not to bring any “old” technology to this new school. After a few weeks of this school merger, some teachers were requesting and searching for their “old” technology. Teachers were not totally resistant to this new environment, but they have successfully designed effective lessons with their “old” technology. The key word is effective, as well as efficient. As long as “old” technology is effective and efficient, it is acceptable to use. However, there is an amendment to this particular right. If “old” technology is not effective and/or efficient, then teachers must be willing to get rid of this “old” technology and replace it with a “new” technology.

*Technology will conform to my proposed needs, not designer's needs:* Notice this relationship. Who is conforming? Technology should conform to our needs as opposed our needs conforming to technology. If designers of a particular technology want to create a successful product, they must attempt to conform to our needs. This right is directly related to Donald Norman's human-centered motto for the twentieth-first century. Norman (1993) notes the 1933 Chicago World's Fair motto was: Science Finds, Industry Applies, Man Conforms. Norman proposes a twentieth-first century human-centered motto. It is: People Propose, Science Studies, Technology Conforms. This new motto now implies that we must be proactive in our expectations of new technology. If a technology is going to be successful and effective in schools, it now must conform to the needs of teachers, administrators, and students. We should expect nothing less from new or old technologies.

*I am a designer of technology, rather than a user of technology:* This right also represents a shift in perspective. Teachers are naturally “designers” rather than “users.” They continually design new lessons, curriculum guides, instructional modules, etc. They rarely take the reactive stance of users in their profession. When interacting with technology, educators should adopt the proactive “designer” viewpoint as opposed to reactive “user” viewpoint. Wilson (1999, p. 16) concurs by stating that “end users [teachers] need to think like designers as well as consumers.” As a “designer”, teachers should expect that technology would enable them to be successful in their designer roles as instructors. Though they may be “using” a particular technology, teachers should continually ask how can this technology enable them to become a more effective “designers.”

*Appropriate technology is redundant or impractical technology is an oxymoron:* This right is a potentially puzzling statement, but actually points to the specific nature of technology. As Ely (1997) notes, too often technology is referred to as an object (i.e., hardware, software). However, if one looks up the definition of technology, one realizes that technology is a process as opposed to an actual “thing.” This particular right describes two qualities of this process. One aspect of technology is that it should be used for *appropriate* reasons. We must adopt the perspective that it is preposterous to think one would use technology for *inappropriate* reasons. True, it is conceivable for someone to use technology for inappropriate reasons (e.g., using a computer to add single digit numbers), but why? This proposed right implies that educators will utilize technology only for appropriate reasons. Otherwise, it is a waste of time. The second aspect of technology is the issue of practicality. The nature of technology is to solve practical problems. In fact, the nature of the field of Instructional Technology is to solve practical problems in instructional settings, as opposed to solving obtuse problems in instructional settings. Again, it would be a pointless activity if educators used technology to conceive of *impractical* solutions.

*It is fine to make "errors" with technology; technology will adapt to my mistakes:* This goes back to the issue of technology *conforming* to our needs. If there are “mistakes”, then the next version must accommodate for these errors. If there is an error message for a particular technology or if something goes “wrong”, then the responsibility falls directly on the shoulders of the designer who created this new technology. One of my colleagues has the following quote in her office: “technology teaches you patience.” This adage embodies the frustration that most of us probably have experienced with current technology. I am sure that I have spent countless hours with a new technology (e.g., software program) when I could have done the same task in half of the time using another means. I was not making “mistakes”, but learning to become more patient with this new technology. This right represents a reversal of roles. Instead of making an “error”, we now must become more patient with the designers’ ill-intended errors. We also must expect that designers will learn their mistakes and adapt their revised versions accordingly.

*Technology is designed to solve my problems:* This right directly equates technology as being a “tool.” In fact, if technology is not being used as a tool, then it probably is being misused. Technology is the means to provide practical solutions. The purpose of this “tool” is to solve problems. By adapting this stance, educators can make clear decisions on how to use a particular technology for a particular situation. If a technology is not going to solve a problem, then there is no reason to use it. Administrators should not expect all of their teachers to use a particular technology if it doesn’t solve *their* problems. The emphasis is on selecting the right tool to solve a particular problem. This right will give a voice to those educators who do not feel compelled to join the latest technology bandwagon, but give them credence to make an informed decision in selecting the appropriate technology to solve their particular problems.

*Technology is designed to help me be more creative:* In addition to solving problems, educators should expect that their technology should facilitate creativity and to become more effective instructors. Thus, technology should be designed so that educators can be creative problem solvers. This is related to Norman’s (1993) “smart, not dumb” concept. Norman notes that technology could either make us “smart” or “dumb”. Technology could entrap us in a senseless stupor such as television viewers staying mesmerized in one spot for countless hours. Or technology could enable us to improve and illuminate our selves where students could interpret the Declaration of Independence from multiple perspectives. It is no question that we need to demand the latter option. If a particular technology does not make educators and subsequently, students “smart”, then, there is no reason to use it.

*The more active technology user I am, the more effective the technology will be:* This is another quality of effective technology and related to the “smart” issue. Educators should expect to be active partners with a particular technology. One should not be “dormant” users and interact with a technology as a “page turner”. Designers should create a dynamic environment where their users are engaged. In fact, “smart” users occur when they are engaged with a particular content area within a dynamic environment. With this expectation, educators not only will be active technology users, but their students also will be.

## **Technology bill of rights for educators: Summary**

Each of these nine rights is deliberately directed towards influencing teachers’ attitude toward technology use. If you consider the reasoning of each right, the cognitive rationale might be lacking. However, this was intended. The description and explanation of these rights resembled more of a “pep talk”, sermon, or another similar affective oral exposition. The intent of these rights are to influence teachers’ beliefs, introduce new principles on how to view technology, empathize with teachers’ frustrations with technology, and inspire teachers to consider an alternative perspective of technology. A more comprehensive cognitive justification was consciously withheld in order to focus on influencing educators’ affective domain.

With the assumption that effective technology adoption involves changing both attitudes and behaviors (Richardson, 1996), this proposed technology bill of rights is concentrated on influencing teacher's attitudes and consequently, changing teachers’ behaviors toward technology. By changing one’s attitude towards the use of technology within schools, teachers could potentially remove several obstacles towards effective technology adoption and integration. The proposed attitude shift, as reflected in this bill of rights, gives teachers the opportunity to take a fresh stance towards use the new technologies, adopt their own vision about technology, and gives them the opportunity to clearly distinguish whether they should adopt these technologies or not.

## **Future directions and a possible covenant**

Another common quality of this proposed bill of rights is its tentativeness. This bill of rights is in its infancy stage and needs further input. Though based primarily upon human-centered design principles, no empirical studies have been conducted to evaluate the efficacy of these rights in changing teachers’ attitudes in adopting and integrating technologies. There are obvious next steps for this type of evaluation. More research on teachers’ existing attitudes towards technology could take place. A comparison of these existing attitudes and proposed attitudes espoused from this bill of rights can be made. From this comparison, a list of interventions could be created in order for teachers to potentially adopt this bill of rights in their own teaching practices. Then, the next question would be to distinguish which rights enable teachers to become effective technology adopters and integrators. Do any of these rights influence teachers’ behaviors towards technology?

This is one strategy. Other similar strategies and input on this bill of rights are welcomed and encouraged. The main point is to further the discussion on encouraging effective technology integration and to encourage mature perspectives of technology amongst educators. Similar to the infancy of our own country, our national bill of rights was debated, discussed and altered. This latest bill of rights could be a catalyst for further discussions on how to promote effective technology adoption and integration within the public schools.

To create an environment of effective technology adoption and integration, we must focus on eliminating first-order technology barriers, as well as second-order technology barriers. Donald Norman’s human-centered design philosophy could be a powerful tool in influencing educators’ perspective towards technology. This human-centered technology bill of rights is a potential means to change the way teachers look at technology and its use in education. This bill of rights also could cause teachers to adopt a more mature view of technology. Adopting the principles outlined in this bill of rights could help educators to view technology as a tool as opposed to other immature perceptions. This bill of rights potentially could be a covenant between educators, administrators, and designers of technology. That is, a proclamation on how these individuals need to change their perspectives towards the use of technology in schools. In his examination of the adoption of twentieth century instructional technologies, Larry Cuban (1986, 1993)

notes that very little technology integration has occurred in schools, since the fundamental goals and understandings of education have not changed. Possibly, this bill of rights can be adopted by educators, administrators, designers and alter this trend.

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# A CONSTRUCTIVIST MODEL OF AN ONLINE COURSE

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## Background

*The Web CT version of the course discussed below is the work of three people at the University of South Florida (USF). They are Barbara Spector, a professor of science education, Barbara Lewis, an instructional designer and computer expert in the Educational Outreach department, and Ruth Burkett a doctoral candidate in instructional technology. They came together 18 months ago when Barbara Lewis arrived at USF. Dr. Spector told her that a need had developed to make her science/technology/society interaction (STS) course available to students through distance learning online. Dr. Spector explicitly stated she believed it could not be done without totally ruining the course, because the course had been designed on constructivist learning theory. It had been taught over five years with several instructors in the room at one time and was highly interactive. Success depended on developing a community of co-learners among the students and the instructors and establishing an environment of trust, which she believed could not be done without consistent live contact.*

*Ms. Lewis said if Dr. Spector could articulate what it took to accomplish what was done in a face-to-face classroom, she could make it happen on the Web. This report attests to the fact that Ms. Lewis was right.*

## Assumptions about constructivism

The following are assumptions about human constructivism (Novak, 1994), the theoretical basis for the design of this course. Humans learn by building on their prior knowledge. They are not empty vessels into which we pour knowledge. Their prior knowledge is organized in a cognitive framework that influences what a person can learn and the ease with which he/she can learn it. Each person's cognitive framework is idiosyncratic and influences (a) the items to which a person will attend in his/her environment, (b) the way the person is inclined to gather and process data about those items, and (c) the Interpretation, or meaning, one makes from the data gathered. Thus the quality and quantity of knowledge one constructs from a learning opportunity is greatly influenced by how much of a match there is between one's cognitive framework and the structure of the learning opportunities available.

## Designing the Web site for constructivist learning

Building on the above understanding of constructivism, the Web site was developed for the comfort of learners regardless of the level of a person's prior knowledge or how a person was inclined to gather and process data (learning approaches). Learning approaches considered in the design included visual, auditory, or kinesthetic, sequential or global, concrete or abstract, sensing or intuitive, and interactive or reflective.

An accommodation for expected variations in prior knowledge related to STS included "just on time delivery" of supporting information to shore up students' idiosyncratic conceptual frameworks. An accommodation for varied approaches to learning was to organize resources on the Web site such that students were encouraged to make choices and determine their own learning pathways through course materials, unrestricted in time or sequence by the instructor. Additionally, students gathered data from a variety of public media sources of their choosing each week, site explorations to business and industry organizations of interest to them in the community, and informal education agencies and local schools of their choosing.

Structuring the course as an open-ended inquiry facilitated students' choices of learning pathways. The open-ended question for this inquiry was: "What is science, technology, and society interaction and its relationship to science teaching?" This format enabled each learner to begin with his/her own level of prior

knowledge, use whatever learning approach was most comfortable, work with others in the course in whatever configuration was preferred, and pursue items of interest. In these ways students were empowered to take charge of their own meaning making, the goal of human constructivism (Novak, 1994).

The combination of a person's idiosyncratic cognitive framework, preferred approach to a learning opportunity, and the personal pathways selected through the resources led to individuals making sense of data in a variety of ways. Sharing these multiple perspectives within the group enabled each learner to make more connections than he/she originally generated, thus making richer meaning and deeper understanding. Sharing these multiple perspectives and how they were derived encouraged members of the group to explore other learning approaches and additional pathways.

Thus the course is iterative. Learners explore resources, gather data, make interpretations, share their interpretations through Web CT's forum, receive feedback from this learning community, explore more resources, reinterpret their data, and share their ideas again. The process is repeated each week as learners' make more connections to deepen the understandings they are constructing and generate their personal grounded theory of STS. While progressing through learning opportunities, they build on their own prior knowledge and experience the interactive nature of learning as they revise and improve the quality of their thinking and understanding (Spector & Burkett, 2000).

### Structure of the Web site

Web CT was used as the course shell because the university provided the software and workshops for faculty as well as continuing technical support for faculty and students. This shell provided a password-protected area necessary to obtain permission for posting copyright-protected materials. The course used all of the tools available in the software package except the quiz.



Figure 1

In this STS course the students developed awareness of science and technology as human enterprises that take place in social, environmental, and historical contexts. The course had four main pages (Figure 1) with more than 270 linked pages. A student entered the main homepage and selected the area he/she wished to explore.

The Syllabus (Figure 2) contained general information about the course. It was setup with an outline on the left for the students to click on information to view in any order or to use the navigational tools to scroll through the syllabus in sequential order. The syllabus also contained active links to enhance and fill gaps in prior knowledge. For example, if a student did not know how to create concept maps and one required learning activity asked students to develop successive concept maps of their leaning every three weeks, then the student clicked on the words “concept map” to view instructions and criteria for creating a concept map. This assignment, along with other open-ended assignments, was a vehicle for learning as well as a source of data for both self-assessment and instructor-assessment.

### Syllabus

- 1. [Syllabus](#)
- 2. [Course objectives](#)
- 3. [General Web Directions](#)
- 4. [Assumptions](#)
- 5. [Appendix A: Comparison of Paradigms](#)
- 6. [Content outline](#)
  - 6.1. [Nature & History of STS](#)
  - 6.2. [Examples of STS](#)
  - 6.3. [Teaching STS](#)
- 7. [Organization of Activities](#)
- 8. [Required Learning Activities](#)
- 9. [Grading Criteria](#)
- 10. [Reference Material](#)

## Science / Technology / Society Interaction

### SCE4237(4 credits)

### College Of Education

#### Syllabus Fall Semester, 2000

**This is a Web Enhanced Course: For computer help telephone 974-2996**

**Instructor:** Dr. Barbara S. Spector

**Telephone:** 813-974-3533 and leave a message with the secretary including you phone number and options for when you may be reached.

**Email:** [WebCT email](#): The most reliable communication is via email:  
  
In an emergency situation only, email me at [spector@tempest.coedu.usf.edu](mailto:spector@tempest.coedu.usf.edu)

**Required Software:** [Inspiration](#) - available for purchase at the USF bookstore. To start immediately you can download the preview available in Software Helps under Student Headquarters. *Caution:* Do not wait until the 30 day trial is up to purchase the program.

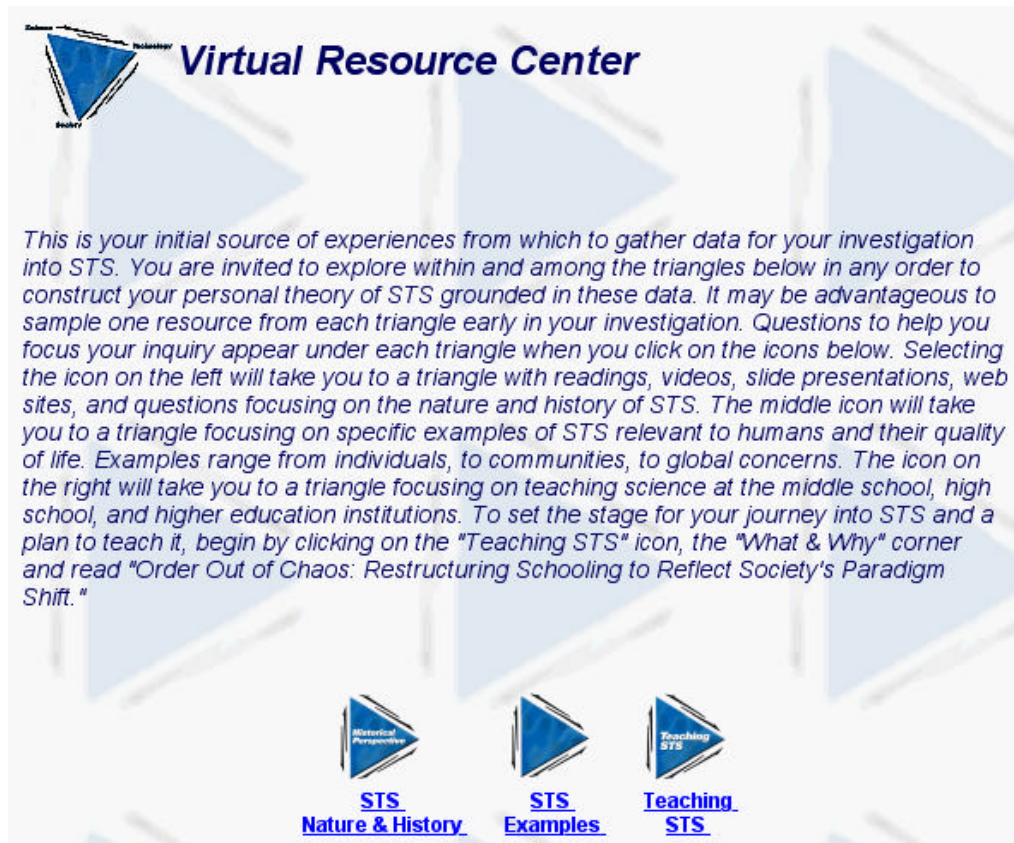
**Course Prerequisites:** (none)

**Class meetings:** Class meetings on the Tampa Campus in EDU 313 are set for the following dates from 8:00 a.m. to 12:00 p.m.: August 29, 2000 and December 6, 2000.  
  
The class is required to meet at Sugg Middle school to participate in a two day science class. TBA.

**Figure 2**

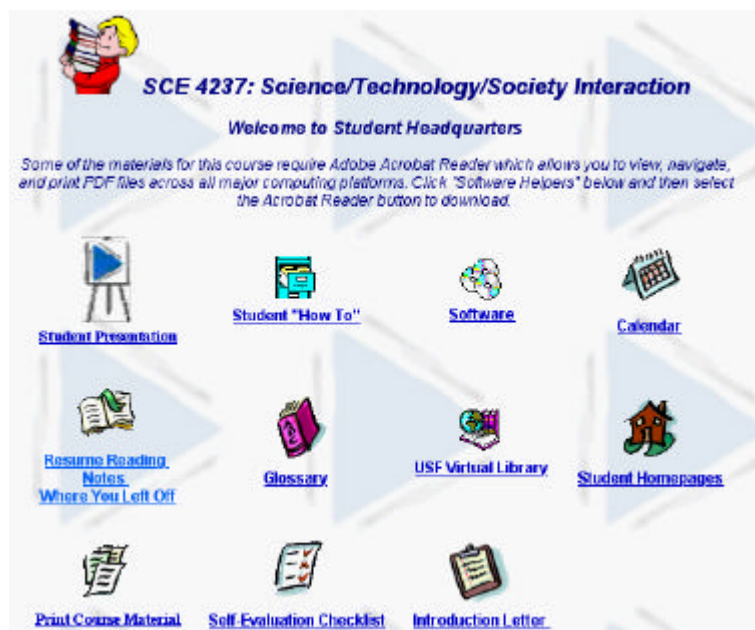
The Virtual Resource Center (Figure 3) was the core of the course, the initial source of experiences from which students gathered data for investigation into STS. The center contained print matter, videotapes, graphics, interactive media, and links to relevant sites on the World Wide Web. These were arranged in three bins: (a) the Nature and History of STS, (b) specific Examples of STS, and (c) Teaching STS. The division into separate bins (categories) was artificial and arbitrary for the convenience of study (Spector & Burkett, 2000). Students were invited to explore within and among the triangles, in any order, to construct their personal theory of STS grounded in data. Questions to help the students focus their

inquiry appeared under each triangle. The icon on the left accessed readings, videos, slide presentations, Web sites, and questions focusing on the nature and history of STS. The middle icon focused on specific examples of STS relevant to humans and their quality of life. Examples ranged from individuals, to communities, to global concerns. The icon on the right focused on teaching science at middle school, high school, and higher education institutions.



**Figure 3**

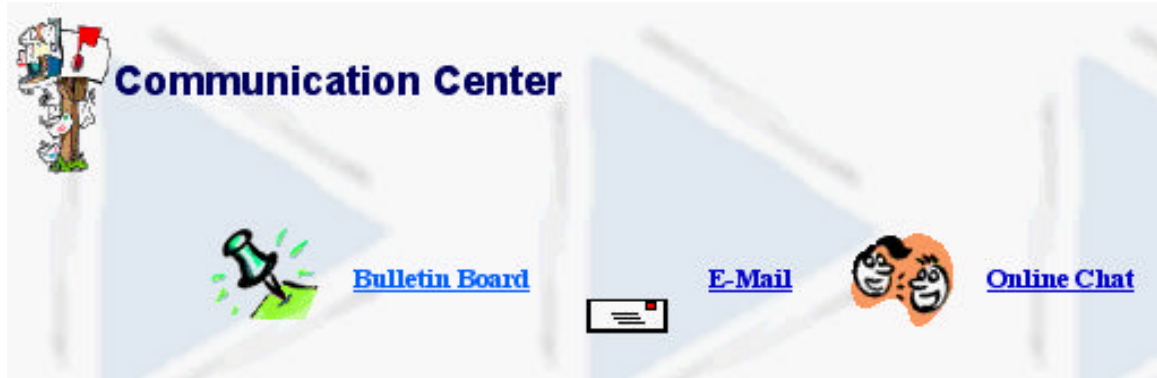
The Student Headquarters (Figure 4) contained (a) links to software needed to access course materials (e.g. Acrobat for print material and Media Player for video) or assist in completion of assignments (e.g. Inspiration for concept maps); (b) how-to directions for creating presentations and student home pages; and (c) other tools students found useful in their inquiry.



**Figure 4**



The Communication Center (Figure 5) facilitated the creation of a community of learners where there was shared responsibility for teaching and learning with a continuing multi-directional dialogue. This is in contrast to the traditional one-way teacher to student input or student to teacher presentation. The bulletin board forums were set up to encourage this dialogue through interaction with other students and the instructor. Reflective journals, media watches, video summaries, and other learning products were posted in the forums as stimuli for discussion. Students were required to respond to each other's postings by critiquing what was written and questioning the reasoning and evidence presented. The instructor responded similarly as a member of the community, not as the authority. Small heterogeneous study groups and groups voluntarily organized to do tasks were free to use the chat rooms built into Web CT for synchronous communication. E-mail was used on occasions when personal, one-on-one communication was needed.



*Figure 5*

## **Conclusion**

This STS course demonstrated a way to provide constructivist learning and teaching online to accommodate varied approaches to learning and differing levels of prior knowledge. The structure of this site shifted the focus from teaching, information transmitted by the teacher, to students gathering information in an on-time delivery mode as they constructed their own ideas about how science/technology/society interact. Key features that enabled this constructivist learning were structuring the course as an open-ended inquiry, creating a virtual resource center with free access, embedding assessment in open-ended developmental instructional tasks, and fostering extensive multi-directional interaction among all members of the learning community on the bulletin board.

Preliminary findings from a study in progress indicate that a community of co-learners developed and students perceived the learning environment to be risk-free, learned to trust each other and the instructor, and participated in intellectual risk-taking leading to significant growth. Thus when placing a course online, it is feasible to maintain the integrity of a highly interactive course developed on constructivist learning theory.

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# THE PROBLEM OF TRANSFER OF TRAINING APPLIED TO THE IMPLEMENTATION OF INSTRUCTIONAL SYSTEMS

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## Abstract

*Transfer of training has focused on learners' capability to apply what they learned to other situations outside the training setting; however, the implementation process can also be thought of as a transfer process. When teachers mediate the instruction as they implement new instruction, they have to transfer the instruction to their own students. This presentation reviews several useful concepts about transfer, such as expected transfer and elicited transfer, and then applies them to the implementation of instruction. A new theoretical construct, transfer alignment coefficient, is introduced and the practical implications of these concepts for instructional developers is explored.*

## Transfer of Training: Problem Definition

Transfer of training has focused on learners' capability to apply what they learned to other situations outside the training setting; however, the implementation process can also be thought of as a transfer process. When teachers mediate the instruction as they implement new instruction, they have to transfer the instruction to their own students. This presentation reviews several useful concepts about transfer and then applies them to the implementation of instruction. A new theoretical construct, transfer alignment, is introduced and the practical implications of these concepts for instructional developers is explored.

One topic from the literature which has not been traditionally associated with the topic of implementation is the problem of transfer of training (Bransford, 1979; Clark & Voogel, 1986; Cronbach & Snow, 1977; Mayer, 1980). Transfer has been defined as learners' capability to apply what they learned to other situations outside the training setting. The two kinds of transfer are:

1. *Near-transfer*. This occurs when learners' "performance reaches established criterion levels on the type of tasks and in the setting defined by the training" (Clark & Voogel, 1986).

2. *Far-transfer*. This occurs when learners are "able to apply [learned] skills in contexts that are very different than the ones encountered during training" (Clark & Voogel, 1986).

Rumelhart and Norman (1981) imply that different types of learning objectives may contribute to different transfer levels. The following types have been identified:

1. *Procedural* objectives are those that represent learning where sequences of steps are taught, procedures; for example, how to diagnose and repair an engine. Gagné (1985) calls this type of objective "intellectual skills." Once these procedures are learned, it is expected they can be applied to solve similar situations, such as diagnosing and repairing another similar engine.

2. *Declarative* objectives are those concepts and principles that are known, e.g., the principles and concepts of internal combustion engines. Gagné (1985) refers to declarative knowledge as "verbal information." Declarative knowledge is expected to be learned so that it can be generalized to solve unencountered problems, such as generalizing the principles and concepts of internal combustion engines to the science of gases.

3. *Conditional* objectives can be extrapolated as a third type of learning objective not mentioned by Clark and Voogel (1986) but identified as a kind of knowledge. Conditional objectives allow learning of when and why certain procedural or declarative knowledge should be applied. This is related to Gagné's (1985) cognitive strategies. Conditional knowledge is at the crux of far-transfer learning, knowing when and why to apply previously learned knowledge in solving unencountered problems.

4. *Experiential* objectives are those objectives that instead of specifying a certain learning outcome, they specify a certain type of experience from which students construct meaning. These type of objectives can be associated with constructivist instructional strategies.

In the opinion of Clark and Voogel (1986),



Existing instructional design models (e.g., Reigeluth, 1983) tend to focus more effectively on near-transfer, procedural objectives, than on far-transfer, declarative [and conditional] ones. The reason for this narrow focus of instructional design models probably lies in their different theoretical origins. Most established and tested design models have been derived from behavioral learning theory. Recent models tend to owe more to the newer but more tentative cognitive learning theories. Each kind of theory proposes a different set of instructional methods to facilitate transfer. (p. 115)

Transfer received much attention from the behaviorist point of view in the first half of the 20th century (Ellis, 1965). This research focused on the identical elements model, which suggests that transfer improves as the training and application contexts approach in their similarities. Many behaviorally based studies provide evidence that generally, positive transfer increases when overall training and application conditions are similar, and the identical elements-transfer relationship is maintained across a variety of learning tasks and training-application contexts.

Criticisms of the behavioral transfer model (Bransford, 1979; Cronbach & Snow, 1977) suggest that only near-transfer is facilitated by identical elements training methods. Cronbach and Snow (1977) conducted a review of behavioral instructional research. They concluded that students with a higher general-ability were able to achieve far-transfer in these studies, but only as a consequence of their ability, and not as a result of training. Behavioral training methods, it seems, primarily tend to support near-transfer learning which does not extend to different content, or tasks for students with middle- or lower-abilities.

Behavioral methods typically include a focus on behavioral objectives that guide instruction and evaluation, instruction that directs and monitors student progress, and shorter instructional segments or frames. These instructional segments are situations where language is simplified and standardized, practice to criterion is encouraged, corrective feedback and reinforcement are given, and tests follow instruction immediately. In most cases, behavioral models seem to encourage the teaching of procedures. An example of this may be found in statistics courses that teach solution procedures rather than underlying principles and concepts.

Cognitive instructional models seem to promote far- or farther-transfer. Cognitive instructional methods include encouraging discovery strategies; suggesting the use of previously acquired and decontextualized skills through, for example, paraphrasing, advance organizers, and analogies, and an emphasis on testing the generalizability of learning. DiVesta and Peverly (1984), in one of the few studies to compare behavioral and cognitive methods for promoting transfer, showed that far-transfer was highest in the cognitive treatments of their experiment. Rumelhart and Norman (1981) have described a number of studies where analogies have provided efficient, far-transfer knowledge of new information, whereas behavioral methods seek to influence learners' overt behavior directly, cognitive methods attempt to promote the students' mental connection of new knowledge with analogous, useful, and/or meaningful prior learning. This connecting of knowledge from dissimilar contexts may be the reason for cognitive methods promoting far-transfer.

Clark and Voogel (1986) conclude that, "Based on the available evidence, it is reasonable to assume that behavioral methods promote near transfer and procedural learning; whereas, cognitive methods yield farther transfer and declarative [conditional] learning."

### **Transfer Alignment Coefficient: A New Theoretical Construct**

Transfer research has focused on the way students apply learning elsewhere; however, the implementation process can also be thought of as a transfer process. When teachers mediate the instruction as they implement an instructional system, they transfer the information to their own students. With this perspective in mind, two related concepts—expected transfer and elicited transfer—can be defined.

Expected transfer is the type of transfer (near or far) necessary to effectively transfer different types of learning outcomes (procedural or declarative). For example, the expected transfer for a declarative learning outcome is far transfer. The more conceptual the learning objective, the farther the expected transfer would be; conversely, the more procedural the learning objective, the nearer the expected transfer would be. Figure 6 describes this concept.

Elicited transfer is the type of transfer (near or far) most likely to be achieved by the type of instructional strategy (behavioral or cognitivist) the instructional system prescribes teachers to use for teaching different outcomes. For example, if the instructional system uses cognitive strategies for the teacher to teach, the elicited transfer is far. The more cognitive or constructivist the instructional strategy of

the system, the farther the elicited transfer would be; conversely, the more behavioral the instructional strategy, the nearer the elicited transfer would be. Figure 7 portrays this concept.

Therefore, *transfer alignment*,  $T$ , is the correlation coefficient ( $-1 < T < 1$ ) between the expected and the elicited transfer per learning objective. If the instructional strategies used by the instructional system to teach different types of learning objectives elicit the same type of transfer as would be expected for the type of objective, then the transfer alignment would be strong (close to 1, aligned). If there is no relationship between the chosen instructional strategies and the type of objectives (for example, a uniform behavioral approach is used to teach all sorts of learning objectives), transfer alignment would be null (close to 0, unaligned). If the wrong strategy is used to teach the objectives or to teach the teachers how to teach these objectives (as in the case when the instructional system behaviorally prescribes for instructors how to teach cognitivist strategies to achieve cognitivist outcomes), transfer alignment would be negatively correlated (close to  $-1$ , misaligned). This is graphically depicted in Figure 8 below.

For example, if the instructional system deals with procedural learning outcomes and uses behavioral teaching methods, then teachers only need to achieve near-transfer of the instruction to their learners. The type of learning, teaching methodology, and transfer required are aligned.

On the other hand, if the instructional system deals with declarative and conditional learning outcomes but uses behavioral teaching methods, or the system behaviorally requires teachers to use cognitive methods, then teachers may only be able to achieve near-transfer of the instruction to the learners. Simultaneously, they must realize that the system is inadequate in achieving the level of far-transfer required to meet the declarative and conditional learning outcomes. There is a misalignment between the type of learning, teaching methodology, and transfer required.

### **Transfer Alignment, Application to Implementation**

Why would transfer alignment be important? Achieving the right type of transfer is an integral part of the learning process. If learners cannot apply what they learned to other situations outside the training setting, then we cannot claim that the learning objectives have been achieved. Clark and Voogel (1986) showed that different types of transfer, near or far, are needed to learn procedural or declarative objectives and that different instructional strategies, behavioral or cognitivist, are more likely to promote different types of transfer. The better align these three are, the more likely that students will successfully transfer their knowledge. Poor transfer alignment is like hammering nails with a screwdriver.

For teachers charged with the implementation of a new instructional system, transfer alignment refers to the alignment not only between the type of learning objectives and the teaching strategy they are told to use to achieve these objectives, but also between the instructional objectives and the instructional strategy the system uses to tell the teacher how to teach. This second type of alignment may not be readily recognized and it could be ignored by instructional developers. This would be the case, for example, of an instructional system which tells teachers how to use appropriate cognitive strategies to achieve some declarative learning outcomes but it does so by prescribing teachers' behaviors. Because the use and application of cognitive instructional strategies is in itself a declarative outcome, unless teachers are taught cognitively how to use these strategies they will be unable to achieve the necessary far transfer for them to apply the strategies in their classrooms.

What effect would transfer alignment have on implementation? A positive alignment would have the effect of increasing implementation because teachers would be more likely to achieve the appropriate type of transfer as they teach with the instructional system.

This presentation explored the concepts of transfer of training including that of Transfer Alignment, alignment between learning outcomes, instructional strategies, and transfer, as applied to the implementation process. Several implications for improving the development of instructional systems were offered.

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# Transfer of instructional systems

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- Expected Transfer

- ▶ The type of transfer (near or far) necessary to effectively transfer different types of learning outcomes (procedural or declarative).

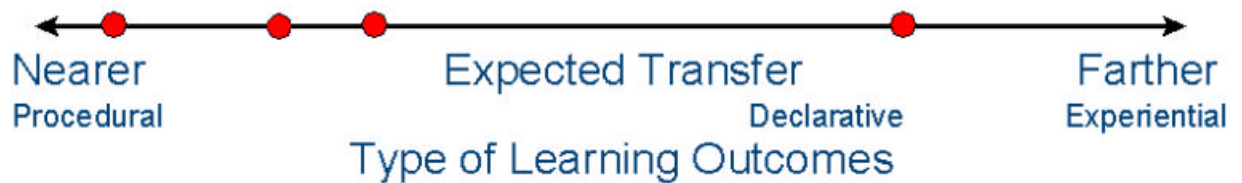


Figure 6. Expected Transfer as a the type of transfer required by the types of learning outcomes.

# Transfer of instructional systems

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## ■ Elicited Transfer

- ▶ The type of transfer (near or far) most likely to be achieved by the type of instructional strategy (behavioral or cognitivist) the instructional system prescribes teachers to use for teaching different outcomes.

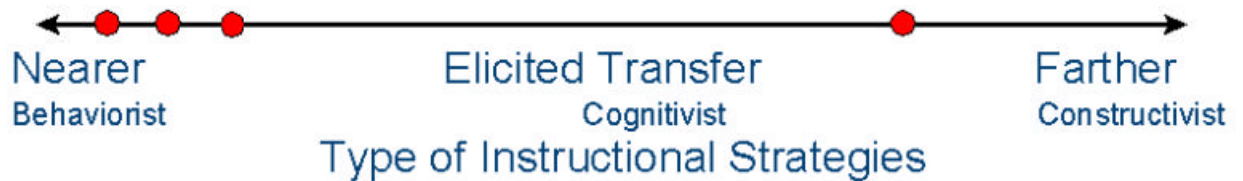


Figure 7. Elicited Transfer as the type of transfer promoted by the system's instructional strategies.

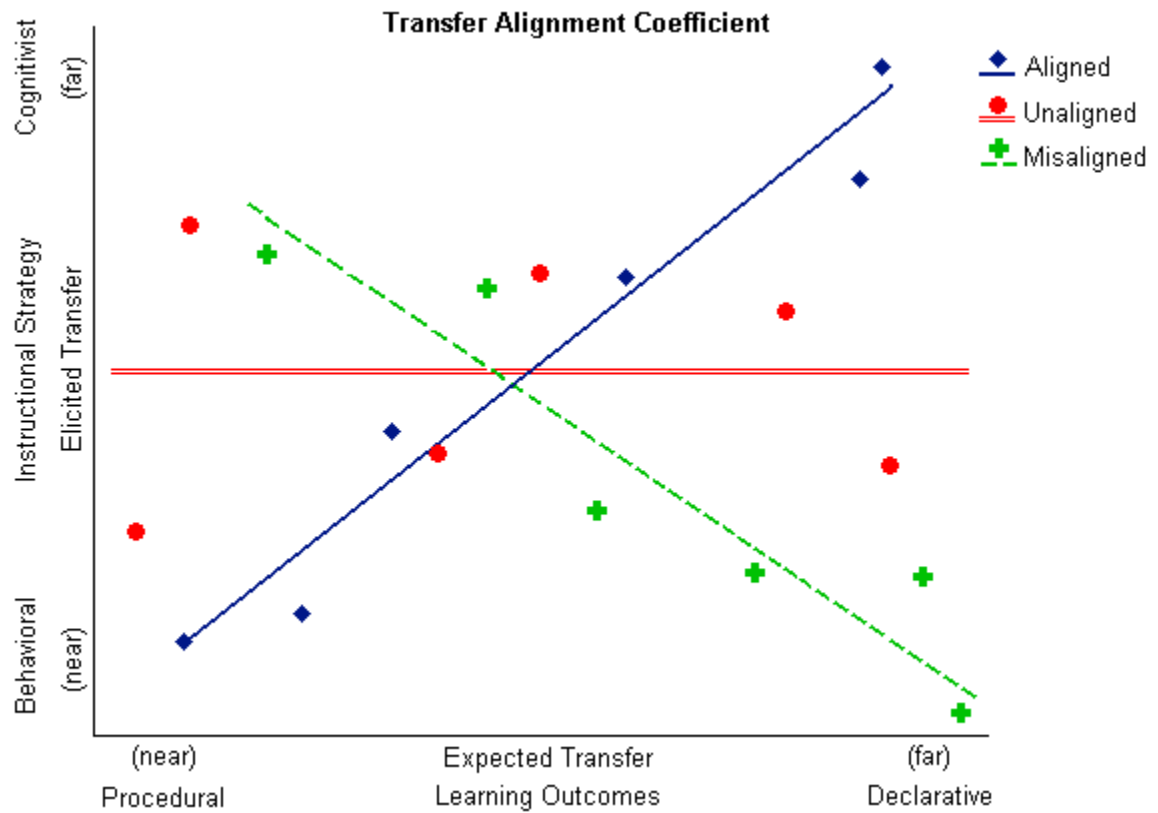


Figure 8. Transfer alignment as the correlation coefficient between expected and elicited transfer per instructional objective for three different instructional systems.

# GUIDELINES FOR INSTRUCTIONAL SEQUENCING IN EMOTIONAL LITERACY LEARNING-USING PATHS CURRICULUM AS AN EXAMPLE

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## Abstract

*The purpose of this paper is to provide guidance for instructional sequencing in emotional literacy curricula. First, the concepts of instructional sequence and the problems involved with instructional sequence in affective domain of learning are addressed. Then, through the analysis of the emotional literacy curriculum Promoting Alternative Thinking Strategies (PATHS) as an exemplary case, general principles are inferred for instructional sequencing in emotional literacy learning. From these, principles for micro-level (within-lesson) sequencing and macro-level (curriculum) sequencing are derived. Factors influencing these sequencing principles are discussed.*

## 1. Introduction

Within the wide range of opinions on the best way to categorize types of learning, Bloom's (1956) categorization of learning into three domains--cognitive, affective, and psychomotor--is the most widely accepted. The cognitive domain of learning "deals with the recall or recognition of knowledge and the development of understandings and intellectual abilities and skills" (Reigeluth & Moore, 1999, p. 52). The affective domain of learning "refers to components of affective development focusing on internal changes or processes, or to categories of behavior within affective education as a process or end-product" (Martin & Reigeluth, 1999, p. 486). The psychomotor domain of learning "involves athletic, manual, and other such physical skills" (Heinich, Molenda, & Russell, 1993, p. 41). Scholars, researchers, and practitioners in the educational fields have been endeavoring to design and develop curricula and instructional methods that will promote effective and efficient learning. Among these three domains of learning, cognitive learning and psychomotor learning have, up until now, received the most scholarly attention and benefited from the greatest and most sophisticated efforts in design, development, and practice. Meanwhile, comparatively little progress has been made toward designing and developing curricula and instructional methods in affective learning (Beane, 1990). Among the major reasons for this state of affairs are the currently uncertain and unclear notions of the proper definition and scope of affective learning, and a prevailing over-general approach that makes it more difficult to undertake scholarly research in this area (Bills, 1976; Beane, 1990). As a result, the affective curriculum does not fully encompass the scope of the affective domain of learning, but often emphasizes the teaching of only certain dimensions (such as the "moral"), while paying little overt attention to other dimensions (such as the "emotional").

In order to better design and develop curricula and instructional methods in the affective domain of learning, Martin & Reigeluth (1999) divide it into six dimensions: emotional development, moral development, social development, spiritual development, aesthetic development, and motivational development. Each of these six dimensions is associated with its own unique components of instructional value, such as knowledge, skills, attitudes, etc. (Definitions and associated components for each dimension are tabulated in figure 1 and figure 2.) Clearly, the fact that each of these dimensions has its own unique criteria for consideration in instructional sequencing and instructional methods poses difficulties for anyone who wishes to design instructional strategies for use within the affective learning domain. Because of space limitations, I will restrict my discussion of the reasons for this state of affairs to the latter part of this paper. The major focus of this paper will be on the question of sequencing in the development of emotional learning. This topic is very seldom discussed. However, with the recognized importance of emotional education in present day society (Goleman, 1995), there exists an urgent need to design and develop emotional literacy learning soon, so that educational methods to develop an emotionally-mature personality can be implemented starting at the early stages of childhood.

<b>Term</b>	<b>Definition</b>
Emotional Development	Understanding your own and others' feelings and affective evaluation, learning to manage those feelings, and wanting to do so.
Moral Development	Building codes of behavior and rationales for following them, including developing prosocial attitudes, often in relation to caring, justice, equality, etc.
Social Development	Building skills and attitudes for initiating and establishing interactions and maintaining relationships with others, including peers, family, coworkers, and those different from ours.
Spiritual Development	Cultivating an awareness and appreciation of one's soul and its connection with others' souls, with God, and with all His Creation.
Aesthetic Development	Acquiring an appreciation for beauty and style, including the ability to recognize and create it; commonly linked to art and music, but also includes the aesthetics of ideas.
Motivational Development	Cultivating interests and the desire to cultivate interests, based on the joy or utility they provide, including both vocational and avocational pursuits.

Fig. 1. Definitions of the dimensions of affective development (from Martin & Reigeluth, 1999, p. 494)

<b><i>DIMENSIONS</i></b>	<b>COMPONENTS OF INSTRUCTIONAL VALUE</b>			
	<b><i>Knowledge</i></b>	<b><i>Skills</i></b>	<b><i>Attitudes</i></b>	<b><i>Others?</i></b>
<b><i>Emotional Development</i></b>	Knowing that others experience the same emotions you do, such as joy and anger	Recognizing emotions Controlling one's emotions	I want to be happy. I don't like to be angry.	?
<b><i>Moral Development</i></b>	Understanding moral & ethical rules of the culture, such as caring, justice, equality	Moral reasoning skills Problem-solving skills in the realm of morals	I want to be honest. I am in favor of having ethical standards.	?
<b><i>Social Development</i></b>	Understanding group dynamics and democratic ideas, such as the role of a facilitator	Social skills, including interpersonal communication skills	I want to interact positively with others. I am opposed to resolving disagreements by fighting.	?
<b><i>Spiritual Development</i></b>	Knowledge of religious precepts about the spiritual world, such as the nature of the soul	Skills for getting in touch with your inner self Ability to love others selflessly	I want a spiritual life. I am in favor of prayer to build a relationship with God.	?
<b><i>Aesthetic Development</i></b>	Understanding the subjective nature of aesthetics, such as the relationship between one's values and one's judgement	Skills for assessing aesthetic qualities Skills for generating aesthetic creations	I want to surround myself with things of beauty. I appreciate an elegant theory.	?
<b><i>Motivational Development</i></b>	Understanding internal and external rewards for sustained activity, such as joy and sense of accomplishment	Skills for developing one's interests, both immediate and life-long	I want a career that I enjoy. I am opposed to hobbies related to guns.	?

Fig. 2. A conceptual model for affective development (from Martin & Reigeluth, 1999, p. 493)

The paper will begin with a discussion of the concept of “sequencing” as it applies to curriculum development. It will then proceed to a more detailed discussion of sequencing strategies in the emotional



literacy curriculum. In order to arrive at suggested guidelines for sequencing strategies for the emotional literacy curriculum, I will use PATHS, an emotional literacy curriculum program, as an exemplary case for analysis. After the analysis and discussion of PATHS, as well as of other literature in emotional development, I will synthesize a set of guidelines for emotional learning sequencing strategies, and explore their further implications for the design and development of emotional learning.

## 2.1. “Sequencing” in Curriculum and Instruction

There are several crucial decisions to make when designing and developing valid, worth-while curricula and instructional methods. These decisions include selecting educational objectives, selecting learning experiences, organizing learning experiences, and evaluating learning experiences (Tyler, 1949). Tyler goes on to cite three basic guiding criteria to be applied in the organization of learning experiences. These are: continuity, sequence, and integration. “Continuity refers to the vertical reiteration of major curriculum elements” (p. 84); “[s]equence . . . emphasizes the importance of having each successive experience build upon the preceding one but to go more broadly and deeply into the matters involved” (p. 85); “[i]ntegration refers to the horizontal relationship of curriculum experiences” (p. 85). While Tyler views these criteria as sufficient for the building of an effective scheme of organization for learning experiences, he did not provide many further guidelines for “sequencing” in subsequent discussions. Yet this aspect of learning, referring as it does to the “increasing breadth and depth of the learner’s development” (p. 96), is undeniably of central importance in practical curriculum design.

According to Reigeluth (in press), “sequence,” in brief, deals with “how to group and order the content.” And the main factors which govern this grouping and ordering lie in the “relationships” within the content. Up to the present, there are four most popular sequencing strategies in instructional design, each is only concerned with a single type of relationship within the content. They are chronological sequence, procedural sequence, hierarchical sequence and simplifying conditions sequence. “A chronological sequence is based on the temporal order of events” (Leshin, Pollock & Reigeluth, 1992, p. 81). “A procedural sequence, . . . is based upon the relationship of ‘order of performance’ of the steps in the procedure. A hierarchical sequence is based upon the relationship of learning prerequisites among the various skills and subskills that comprise a task. And the ‘simplifying conditions’ sequence is based upon the relationship of the degree of complexity of different versions of a complex task” (Reigeluth, in press).

## 2.2. Sequencing Strategies in Affective Learning

One thing that should be mentioned here is that these sequencing strategies are customarily applied to only two of the three domains of learning: cognitive and psychomotor learning. Sequencing strategies pertinent to affective learning have been neglected. Few researchers and writers have been willing to tackle them. Even the landmark treatise touching on affective learning, *The Affective and Cognitive Domains: Integration for Instruction and Research*, by Martin and Briggs (1986), does not fully address “sequence” nor does it shed light on the principles and guidelines for sequencing in affective learning. However, this does not mean that “sequence” in affective learning is unimportant. On the contrary, this has been the focus of growing attention in very recent years, concerned with an increased acknowledgment of the importance of affective learning. For example, Dr. Charles M. Reigeluth in the field of instructional systems technology has been endeavoring to find valid, proven guidance for making decisions about sequencing in affective learning, with a special focus on emotional literacy learning. It is also under his encouragement and direction that the author is devoting research to this topic. The author may seem rash in making such a commitment--assuming a burden which others have thus far been reluctant to take on. There must be thorny issues in the process, so the mystery of sequencing in affective learning has not been explored. What, then, are the problem(s) or “issues” encountered in this domain?

Because of the incompleteness of the body of literature and research directly investigating the patterns of sequencing in this domain, the author undertook an analysis of an emotional literacy curriculum, *PATHS (Promoting Alternative THinking Strategies)*, in order to infer a set of pragmatic guidelines for sequencing, and factors for influencing the sequencing. Hopefully, this data can begin to provide principles and guidelines in sequencing strategies for further design and development on affective education.

## 3.1. Emotional Development

“Emotional development” in short, is “Understanding [how to] control one’s feelings, and learning to manage one’s emotions” (Martin & Reigeluth, 1999). As stated previously, this dimension of the affective domain of learning already exists as a hidden curriculum, and has been taught implicitly.

Unfortunately this minimal curriculum design paradigm has proven incapable of meeting the demands posed by the mass of family and societal problems caused by emotional disequilibrium. The high degree of serious emotional disequilibrium in today's families and societies is surely, to some extent, a reflection of the large quantity of sad and violent crime events, emotional ineptitude, emotional abuse, desperation, and recklessness reported in any day's newspaper (Goleman, 1995). In such an environment, children are and will be the victims. As Daniel Goleman (1995), a Harvard psychologist, states, "[a] massive survey of parents and teachers shows a worldwide trend for the present generation of children to be more troubled than the last: more lonely and depressed, more angry and unruly, more nervous and prone to worry, more impulsive and aggressive" (p. xiii).

This emotional crisis has been expounded rather clearly in Goleman's popular treatise, ***Emotional Intelligence: why it can matter more than IQ*** (1995). This book, which bases its conclusions on studies of the brain's structure and function, and draws on the related fields of physiology, neurology, psychology and behavior, etc., has revealed much about how the human "emotional mind" functions and its significance in directing human behavior throughout life. Goleman points out that the factors which lead to success in life and career involve not only the Intelligence Quotient (IQ) but also a more dominant index: the Emotional Quotient (EQ). Goleman states that the emotional quotient represents self-awareness and impulse control, persistence, zeal and self-motivation, empathy and social deftness. He further indicates that an individual with higher emotional intelligence tends to have better opportunities and greater success in any field.

Research has shown that emotional development occurs ahead of cognitive development (Greenberg & Kusché, 1993). It is further suggested that EQ is not genetically determined, but can be nurtured and strengthened for years after birth by emotional literacy programs designed to enhance emotional intelligence. Goleman urged that our schools should have emotional curricula to prepare our young for successful life. He outlined several vital curricula on emotional literacy for elementary students, designed to direct them to manage their feelings and solve daily interpersonal conflicts. Among these the one most suitable for my project, and hence chosen here as a case for study, is the PATHS curriculum, developed by Greenberg, Kusché, and associates.

### **3.2. The PATHS Curriculum**

#### **The Purpose of PATHS**

"The purposes of The PATHS Curriculum are to enhance social and emotional competence and understanding in children, as well as to develop a caring, prosocial context that facilitates educational processes in the classroom (The PATHS instructional manual, p. 1)". This is an experimental-based program initially designed for deaf children. The original title is called ***Promoting Social and Emotional Development in Deaf Children: The PATHS Project*** (Greenberg & Kusché, 1993). Since 1982 this program has been revised and expanded to meet the needs of different types of children and of multi-culture. This program is designed for kindergarten through 6. It can not only serve as an intervention program for children with physical or mental or cognitively delayed or severe behavioral disturbance or emotional problems, but also can serve as a prevention program for normal or regular or even gifted children. And this program has been successfully applied in all above different types of children.

PATHS can be effective as both a prevention and as an intervention program (Greenberg & Kusché, 1993). "These dual functions are especially of practical value to educators, since today's classrooms generally include a mixture of children who are in need of intervention as well as children who are not: at risk," but who can nevertheless benefit from prevention programs designed to reinforce healthy functioning. We have found PATHS to be useful with a variety types of children" (The PATHS instructional manual, p. 2).

#### **Theoretical Roots**

The design of PATHS takes into account aspects of diverse theories of human behavior and development. According to the authors, these theories include developmental social cognition (e.g., Greenspan [1981] and Shantz [1983]), cognitive developmental theory (e.g., Dewey [1894, 1933] and Piaget [1981]), psychoanalytic developmental psychology (e.g., Freud [1981], Nagera [1966], Pine [1985]), and attachment theory (e.g., Bowlby [1973, 1982]), interpersonal development (e.g., Selman [1980]), interpersonal problem solving (Spivak, Platt & Shure [1976]), moral development (e.g., Kohlberg [1980]), cognitive-social learning (e.g., Bandura [1986]), cognitive-behavior therapy (e.g., Kendall & Braswell [1985], Meichenbaum [1977]), Bretherton [1985], Main et al. [1985]), and so on (Greenberg & Kusché, 1993).

These above research studies have been integrated into the so-called Affective-Behavior-Cognitive-Dynamic (ABCD) theoretical model of development, which forms the foundation PATHS. The ABCD model emphasizes the dynamic relationship among affect, behavior, and cognition, integrating these three aspects so as to facilitate children's positive and healthy personality development and social functioning throughout their different developmental phases (Greenberg & Kushé, 1993).

### **Learning Goals**

PATHS addresses the following goals in the areas of social and emotional development:

1. Increased self-control.
2. Enhanced self-esteem, self-confidence, and the ability to give and receive compliments.
3. Increased understanding and use of the vocabulary of emotions, verbal mediation, dialoguing, and interpersonal communication.
4. Improved ability to recognize and interpret the differences between feelings, behaviors, and perspectives of self and others.
5. Understanding of attributional processes that lead to an appropriate sense of self-responsibility.
6. Recognition and understanding of how one's behaviors affect others.
7. Enhanced motivation and use of creativity.
8. Increase understanding and use of logical reasoning and problem-solving vocabulary.
9. Improved knowledge of, and skill in, the steps of social problem-solving: leading to the prevention and/or resolution of problems and conflicts in daily life.

(The PATHS Instructional manual, p. 2)

These nine goals are designed to develop the child's self-control, positive self-esteem, emotional awareness and management, and interpersonal problem-solving skills. They are quite inclusive, and are consistent with the essential components of the current dominant conceptual models or frameworks for emotional intelligence. PATHS comprises one hundred and thirty-one lessons, each lesson taking about 20-30 minutes of classroom time. These lessons are classified into four major units: readiness and self-control (1 volume), feelings and relationships (3 volumes), problem-solving (1 volume), and supplementary lessons (1 volume). These units deal with five major conceptual domains: self-control, emotional understanding, building self esteem, relationships, and interpersonal problem-solving skills.

### **Philosophy Underlying the Goals**

The philosophy intrinsic to PATHS reflects the authors' belief in educating the whole child, which is compatible with John Dewey's philosophy of wholistic education (The PATHS Instructional manual, p. 8). The wholistic approach to education entails treating language, cognition, memory, emotion, and behavior as intimately interrelated and all-important aspects of every child's personality. In accord with this philosophy, the authors affirm that

Emotions affect all of us on a daily basis throughout our lives. Understanding and dealing with our feelings and those of others are therefore areas that will be of continual concern to all of us, whether or not we are aware of this. Understanding emotions often becomes more complex as we get older. Further, sharing emotional issues with others continues to be at least one of the major motivations for social interaction and is often the "glue" for intimacy and friendship (Youniss, 1980; Selman, 1980)." (Instructional Manual, p. 125)

Unfortunately, traditional education has emphasized the acquisition of cognitive skills much more than that of aspects of emotional cultivation, such as emotional awareness, emotional control, and so on. Thus, children have never been taught through a systematic emotional development curriculum, and teachers, more familiar with instructional methods in cognitive learning than with those for emotional learning, have less confidence in teaching emotional learning. Since PATHS provides a complete curriculum and more than one hundred lesson plans on emotional literacy for elementary school, it may offer elementary teachers a new level of confidence and comfort in thinking about wholistic education and teaching in a wholistic way.

### **Instructional Methods**

PATHS is intended to be a separate course within the general curriculum, and is suited to the k-6 elementary years. It employs a variety of instructional methods. Because it concentrates, not on teaching cognitive skills, but rather on cultivating affect, it combines a variety of instructional methods so as to promote progressive emotional and behavioral change in the individual. These instructional methods include dialoguing, role-playing, story-telling, simulation, modeling, social and self-reinforcement,

attribution training, and verbal mediation. Visual, verbal, and kinesthetic modalities are combined to promote learning. These instructional methods are mostly intended to be conducted by the teachers; however, parents are also expected to participate in modeling outside the school environment.

### **The Significance of PATHS**

**The PATHS program has achieved improvements in several areas of children's learning. Goleman notes (1995, p. 306), that the PATHS curriculum has been successful in the following areas:**

- Improvement in social cognitive skills
- Improvement in emotion, recognition, and understanding
- Better self-control
- Better planning for solving cognitive tasks
- More thinking before acting
- More effective conflict resolution
- More positive classroom atmosphere

For the purpose of this project, only the **Feelings and Relationships Unit** is included for investigation because it represents the major portion and thrust in emotional literacy.

### **4.1. Micro-Level (Within-Lesson) Sequencing Strategies in PATHS**

Basically, the pattern of sequencing within each lesson of the Feelings and Relationships Unit follows seven steps set out by the developers of PATHS (PATHS, v.1, p. xxix). Figure 3 shows these seven steps (PATHS, v. 1, p. xxix), as well as an example of the script of a lesson on HAPPY (PATHS, v. 1, pp. 43-44).

<b>Step of a Lesson</b>	<b>Script of a Lesson on HAPPY</b>
<b>1. Presenting a given emotion with a simple definition.</b>	Happy is the way we feel when we are glad about something or when we enjoy something.
<b>2. Showing pictures of the emotional expression.</b>	(Take the Happy Feeling Face out of the Feelings Chart and show it to the class.) This Feeling Face shows someone who is feeling happy. Do you think that happy feels comfortable or uncomfortable inside?
<b>3. Providing examples of situations that typically elicit the feeling.</b>	We can feel happy for a lot of reasons. There are lots of times we feel happy, like if we get to go some place we really like, if we get to play with our friends, if we get something really special, and so on.
<b>4. Having the children talk about times when they have experienced the emotion.</b>	Can anyone think of a time when they felt happy?
<b>5. Modeling and labeling the feeling as a group.</b>	Now let's look at two photographs of people who feel happy. (Point out the features that indicate happiness...Model as needed for further clarification or demonstration.)
<b>6. Having the children make "Feeling Faces".</b>	Now let's all practice the word HAPPY together. I want all of you to think about how you feel when you feel happy. Try to make your body feel happy and make your face look happy. Try to feel happy inside.
<b>7. Providing the children with an activity through which the emotion can be experienced on a more personal level.</b>	Then, while you are feeling happy, I want all of you to say the word HAPPY together. Then we will all spell it together. Then we will say it and spell it again. After that, we will say the sentence "I feel happy" together. If you need to remember how to spell the word happy, look up at the Feelings Chart or the board (or overhead) where I have written the word. Is everybody ready? Good. Let's all look and feel HAPPY and practice the word together.

Fig. 3. Seven steps of a lesson and the script.

At first glance, the seven steps of PATHS may seem superficial and oversimplified. However, by deeply pondering on these seven steps, it is apparent that they show an interesting model of sequencing of content in emotional literacy. The seven steps are converted to the following analysis (see Figure 4):

<b>Step of Sequencing Strategies</b>	<b>Domain of Learning</b>	<b>Guideline of Sequencing Strategies</b>
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<ol style="list-style-type: none"> <li>1. Presenting a given emotion with a simple definition.</li> <li>2. Showing pictures of the emotional expression.</li> <li>3. Providing examples of situations that typically elicit the feeling.</li> <li>4. Having the children talk about times when they have experienced the emotion.</li> <li>5. Modeling and labeling the feeling as a group.</li> <li>6. Having the children make "Feeling Faces".</li> <li>7. Providing the children with an activity through which the emotion can be experienced on a more personal level.</li> </ol>	<ol style="list-style-type: none"> <li>1. Concept generalization. (Cognitive)</li> <li>2. Concept classification. (Cognitive)</li> <li>3. Principle learning. (Cognitive)</li> <li>4. Cognitive &amp; emotional.</li> <li>5. Cognitive &amp; emotional.</li> <li>6. Behavioral.</li> <li>7. Emotional &amp; empathy.</li> </ol>	<p>Cognitive-to-Behavior-to-Affective</p> <p>External-to-Internal</p>
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Fig. 4. Micro-level sequencing strategies in PATHS.

Step 1 gives a definition of one kind of emotion which seems to deal with the **concept generalization**. Pictures of facial expressions shown in step 2 depict the **concept classification**. Therefore, both these first two steps are aimed at the cognitive aspect of learning, which strives to recognize, understand and even discriminate between and among the concepts of certain feelings. In step 3, kinds of situations eliciting the feelings are shown to point out that there is a cause and effect relationship between the two. This is dealing with **principle learning**. Each of these three steps is concerned primarily with the cognitive domain of learning, which "deal[s] with the recall or recognition of knowledge and the development of understandings and intellectual abilities and skills" (Reigeluth & Moore, 1999. P. 52).

In step 4, the learners must talk about times when they have experienced the feelings already conceptualized and situated (by example). The learner is called upon to reach into his/her personal feelings and connect these concepts and practices to the actual, felt emotion. Although this is still cognitive-oriented, it goes to a deeper **emotional level of learning**.

In step 5, modeling and labeling the feelings enables learners to recognize the feeling through a cognitive-based approach. This combines the **cognitive and affective components**. In step 6, having the children make "Feeling Faces" entails asking the learners to exhibit the emotions as if they actually were feeling them. They are asked to show these feelings by their facial expressions, and further, they are asked to imagine the feelings as they do this. This requires them to emphasize the feeling **beyond the cognitive-based learning**. This combines the **behavioral and affective components (a sense of empathy)**. Step 7 deals with a specific individual situation for feedback on how each learner would react emotionally. An example would be to ask "How would you feel if your money were stolen?" This level asks the learners to internalize the situation and to simulate their own **emotional reaction**. This brings to awareness as closely as possible the feelings available to each of the learners.

In conclusion, in analyzing the seven steps of sequencing within a lesson, it becomes apparent that the within-lesson sequence is mainly structured so as to proceed from cognitive to behavioral to affective, and from external to internal through recognition, reflection and ultimately to the empathetic--(emotional)--state which is feeling. These sequencing strategies are synthesized in figure 4.

#### 4.2. Factors Affecting Within-Lesson Sequencing Strategies in PATHS

The author has been endeavoring to uncover the rationale, or theoretical roots, embedded within the practice of the within-the-lesson sequencing strategies shown above. It has been found that the arrangement of within-lesson sequencing strategies is consistent with the following rationale and practice:

According to Kusché, Between ages five and seven, there are several changes in emotional development, including:

- the spontaneous generation of emotional concepts

- identification of anger
- understanding cause-effect relationships
- emotional perspective-taking
- recognition of emotional facial expressions
- internal-external generation of emotional concepts.

(Personal communication, November 1997)

Therefore, these steps in developmental readiness correspond to these sequencing strategies. Most of these seven steps of sequencing strategies are designed to correspond with developmental readiness. During this developmental stage, language is also believed to provide three ways to facilitate the child's behavioral and emotional control (Greenberg & Kusché, 1993, p. 77):

“First, it serves to communicate one's internal states to others... Second, language provides an internal executive function that can mediate between impulse and behavioral action... Finally, language, and possibly other forms of symbolic representation, allow the child to become consciously aware of his or her feelings.”

One method of facilitating a child's verbal and emotional control is verbal labeling of emotional states, which help the child develop powerful, new forms of self-control and self-expression.

Also between the ages of five and seven, the child's teacher, parents, and other adults play very important parts as role models, demonstrating ways of using cognitive and affective processes for managing frustration, maintaining control during times of emotional turmoil, and dealing with interpersonal conflict. This would benefit the child's emotional development and social competence.

### 5.1. Macro-Level Sequencing in PATHS

Macro-level sequencing analysis deals with how all the topics to be taught in the entire curriculum (i.e., here, the Feelings and Relationships Unit of PATHS) ought to be sequenced. Since the entire unit covers fifty-six lessons of several topics, it is not easy at the beginning to figure out thoroughly all kinds of sequencing to be applied, especially in an implicit way. Therefore, the author begins with the analysis of the sequencing patterns in the unit, to see if they follow in a topical or a spiral sequence. This is not an easy task because the connotations of the families of emotional feeling words are controversial, especially those which pertain to more complex feelings. Several schools of research on emotion have already created families of classifications. These share some similarities, but the differences have created some considerable controversy (Goleman, 1995). This may produce various interpretations of the sequencing at the macro-level content. Unfortunately, the developers of PATHS do not fully elaborate on the classification of families of emotions, but simply separate all feeling words into “comfortable” and “uncomfortable” feelings for the convenience of children to relate to them. Therefore, the author of this paper had to delineate less generally to achieve a more complete classification of words.

To begin classification, the author first reviewed the content of each PATHS lesson carefully to understand the meaning of the feeling words in the context of the lessons. This process helped the author to arrive at a more distinct classification of many of the words. However, the remaining words were fuzzy in personal interpretation, vague, and complex in nature. Therefore, to achieve a better approach, the author has consulted subject matter experts and academic research materials on emotions (Goleman, 1995; Ortony, Clore & Collins, 1988, p. 27). Finally, a classification figure was produced: Genera of Feelings & Relationships in PATHS (see Figure 5.). Because the Feelings and Relationships Unit covers not only feeling words but also other activities involving behavior management in the domain of emotional literacy, the classification figure extends beyond feeling words. This classification helped the author name the topic of each lesson. This made it easier for later analysis of the sequencing pattern to which lessons pertain.

<b>Feeling</b>	A general introduction to emotional state
<b>Enjoyment</b>	Happy, delighted, proud, content, satisfied
<b>Sadness</b>	Sad, a little down, depressed, (disappointed, hopeful), lonely
<b>Private</b>	Private, privacy, hiding feelings
<b>Fine</b>	(Fine, excited, tired)
<b>Anger</b>	Angry, mad, grouchy, grumpy, furious, frustrated, resentful, anger management
<b>Fear</b>	Afraid, (scared, safe), uneasy, terrified, nervous, (anxious, calm or relaxed)

<b>Surprise</b>	(surprised, expect)
<b>Love</b>	(Love, hate), (like, don't like), (kind, malicious), (included, rejected, excluded), generous, forgiving.
<b>Disgust</b>	Disgusted
<b>Shame</b>	Ashamed, guilty, shy, embarrassed, humiliated
<b>Interest</b>	(Curious, interested, bored)
<b>Confused</b>	(Confused, worried, sure)
<b>Observation</b>	Observing emotional clues in other people, observing emotional clues in ourselves
<b>Intentionality</b>	(Accident, on purpose)
<b>Manner</b>	Manner
<b>Change Feeling</b>	Change feeling
<b>Jealous</b>	Jealous or envious
<b>Selfish</b>	Gready, selfish
<b>Note: ( ) denotes antonymous feelings</b>	

Fig. 5. Genera of Feelings & Relationships in the PATHS.

The author then planned the order of each lesson to figure out the flow of the ordering of the topics. From this, a flowchart of lesson ordering was produced (see Figure 7). The flowchart illustrates several findings that are unique in this field of knowledge and will enhance further analysis of the deeper, implicit, and more complex relationships in sequencing. Later parts will have more elaboration.

### 5.1.1. A spiral/topical curriculum

In the flowchart, it shows that the patterns of sequencing of the topics to be taught tend to be a combination of two popular types of curriculum sequencing: spiral and topical sequencing. In topical sequencing, the “topic (or task) is taught to whatever depth of understanding (or competence) is required, before moving to the next one.” (Reigeluth, 1992, p. 2.6) In spiral sequencing, several passes over the material are used to present the basics of each topic, one at a time. After the basics of each topic are taught, each topic is revisited in greater depth. In this form of sequencing, the learner “spirals” through each topic, and each topic is taught until the necessary depth is reached (Reigeluth, 1992). The following sections explain the functioning of spiral sequencing and topical sequencing within PATHS. Figure 6 synthesizes the findings.

<b>Type of Curriculum Sequencing</b>	<b>Guideline of Sequencing Strategies</b>
<b>Spiral Sequencing</b>	<b>Basic-to-complex continuum</b> <b>Hierarchical relationship</b>
<b>Topical Sequencing</b>	<b>General-to-detailed continuum</b> <b>Simplified conditions method</b> <b>Synonymous relationship</b> <b>Antonymous relationship</b>

Fig. 6. Macro-Level Sequencing.

### 5.1.2. Spiral curriculum

Before discussing this section, there are two important continua which need to be addressed: simple-to-complex continuum and general-to-detailed continuum. These two continua have been regarded as important components to the success of instructional sequencing. “The simple-to-complex continuum refers primarily to a continuum formed by adding or removing parts of ideas (either principle or procedures).” (Reigeluth, 1983, p. 346) “The general-to-detailed continuum refers primarily to a continuum formed by subdividing ideas (either concepts or procedures) or by lumping ideas (subordinate concepts or subordinate procedures) together. General has breadth and inclusiveness (i.e., lots of things lumped together, whereas detailed usually narrow (subdivision)” (Reigeluth, 1983, p. 344).

In the flowchart, it shows that the lesson sequence is a combination of both spiral and topical patterns of sequencing. The spiral sequencing in the flowchart is consistent with the simple-to-complex continuum. Here “simple” denotes in PATHS the so-called “basic” or “primary” feelings, such as: happiness, sadness, anger, fear, and so on. These emotions are the basis from which human beings develop other kinds of feelings through interaction with society. And there are more “sophisticated”, “educated” feelings which are born from these basic feelings, and they are entitled “complex” feelings. So “complex” denotes here a blend, or variation, or nuance of feelings (Goleman, 1995). They are composed of more complex ingredients such as interpersonal skills and life experiences, and produce the complexity of guilty, selfishness, and so on. Therefore, the author would like to use “basic-to-complex” rather than simple-to-complex in this paper to avoid any misunderstanding.

Thus some lessons follow in spiral sequence, which means that the lessons which treat basic emotions are taught ahead of time. After these basic emotions have been taught, then those lessons treating complex emotions are taught. In other words, an understanding of basic emotions is treated as a prerequisite for learning about complex emotions, and it is assumed that basic emotions are the ones that complex emotions are based upon. Therefore, we may conclude that a hierarchical relationship exists here. Such basic-to-complex, hierarchical relationships can be seen clearly in Greenberg and associates’ division of the fifty-six lessons in the Feelings and Relationships Unit into 4 levels of complexity (PATHS, 1994, v.1, p.xxiii-xxiiiiv). They are:

- Level 1: basic and intermediate emotions (lessons 1-21)
- Level 2: moderately advanced emotions (lessons 24-33)
- Level 3: observations and manners of emotions (lessons 35-47)
- Level 4: advanced emotions (lessons 48-54)

These 4 levels of complexity demarcate the advancement of spiral sequencing, which proceeds through topics from level 1 to 4. This unique spiral sequencing is consistent with the developmental stages of children (Greenberg & Kusché, 1993). The notions behind the framework of development is concerned with the learner as naive, possibly young, and subject to emotional, physical, and social maturation during the time of instruction.

### **5.1.3. Topical sequencing**

Topical sequencing in the Feelings and Relationships Unit is consistent with the general-to-detailed continuum in that general feelings. For example, Lesson 3: Feeling, is broader and thus taught first, while more detailed feeling, Lesson 4: Happy, Sad and Private is taught later. A lesson of a feeling in general may be adjacent by a lesson (or lessons) of same feeling in another but different “depth.” For example, lessons 35-36 teach “observing emotional clues.” Lesson 35 focuses on “observing other people’s emotions”, but lesson 8 concerns ones’ own emotions.

In topical sequencing, “intensity” of feeling links many lessons; for example, lessons 14-15 teach “fear” with an increase in intensity from “scared” to “afraid”, “uneasy” to “terrified.” Thus, they are sequenced according to the Simplifying Conditions Method. The Simplifying Conditions Method builds from the simplest version, instead of summarizing a topic each time (Reigeluth, in press). For example, under the topic “anger” (Lessons 7-12), each lesson contains a pure and focused dimension of the topic. Lesson 11 covers only “control of anger” and does not include other dimension, such as definitions of words related to the emotion.

Synonymous feelings are often taught together. This allows the learners a variety of expressions for the same, or similar, or synonymous feelings. This is necessary for empathetic communication of sharing feelings. The synonymous relationship occurs within one lesson or in consecutive lessons. For example, “mad” and “angry,” treated as synonymous terms, are dealt with in two parts of Lesson 7.

In the macro-level of curriculum of the Feelings and Relationships Unit, feelings of antonymous relationships often are taught within one lesson or in consecutive lessons. One example is: in lesson 2, the feeling “happy” is taught, and the feeling “sad” is taught as well. Such sequencing allows the learner the opportunity, through “contrast” and “comparison” to understanding tacitly the difference between and among “feelings”. This will imply a reference for learners to refer to later in life as to what “feeling” is appropriate in a given situation. This “antonymous” relationship becomes a unique characteristic in emotional literacy.

## **5. 2. Factors Affecting Macro-Level Sequencing**



### **5.2.1. Spiral curriculum**

As noted earlier, emotional development is restricted by developmental maturation; therefore it is not ideal to teach emotional literacy in a strict or pure sense with either spiral or topical sequencing patterns. As the flowchart shows, due to the level of developmental maturation on different stages of emotional maturation, spiral sequencing should move to a certain degree of complexity, pause, and then move on to a certain degree of detail. Therefore, the basic-to-complex continuum becomes a guiding principle in sequencing. And hierarchical sequencing become necessary when it is believed that some type of emotion should be dealt with as a prerequisite to the treatment of some other type of emotion.

### **5.2.2. Topical sequencing**

Four guidelines are apparent in topical sequencing: a general-to-specific continuum, the Simplifying Conditions Method, synonymous sequencing, and antonymous sequencing. The nature of “intensity” in emotions and the four components of the ABCD model (affective, behavior, cognitive and dynamic) make feelings multiple-dimensional for learning. It is this implicit complexity that calls for the Simplifying Conditions Method, which calls for sequencing that builds from the simplest version, instead of summarization of a topic each time. For example, under the topic “anger” (lessons 7-12), each lesson contains a pure and focussed dimension of the topic. Another example is that lesson 11 covers only “control of anger” and does not include other dimensions, such as definitions of words related to the emotion.

Research maintains that children should learn how to express the same state or feeling with different words (Greenberg & Kusché, 1993). Maybe it is this fact about emotional learning that provides the motivation for PATHS’s synonymous sequencing.

It is interesting that emotions are often contrasted along dichotomies; i.e., comfortable-uncomfortable, pleasant-unpleasant, and so forth. The reliance on dichotomies brings about a reliance on antonymous sequencing.

## **6. Synthesis**

The findings of above analysis of sequencing in terms of micro-level lesson and macro-level curriculum in PATHS have brought out several of the principles that guide the sequencing of emotional literacy in PATHS. Figures 4 and 6 are concise syntheses of the patterns and factors influencing the instructional sequencing in PATHS. We can see that this unique curriculum draws on several sequencing strategies beyond those are used in psychomotor and cognitive learning. These unique strategies may be regarded as reflections of special factors that should be considered when emotional literacy lessons are being sequenced. Their appearance here suggests that it will not be appropriate, in curriculum design for affective learning, to simply reuse the sequencing principles proper to procedural and cognitive learning. Further guidance from research and practice should be sought in order to obtain a more comprehensive set of guidelines for emotional development education. Accordingly, instructional designers engaging in creating instructional sequencing appropriate to an emotional literacy curriculum’s specific demands might wish to draw on the guidelines elaborated here.

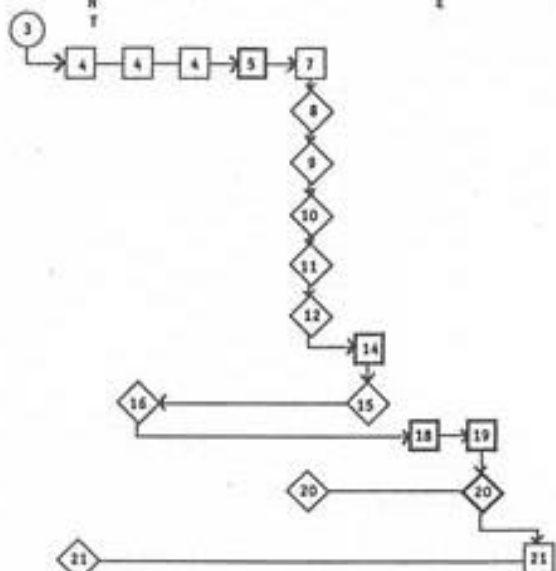
## **7. Conclusion**

The purpose of this paper is to provide guidance for emotional literacy learning by analyzing and synthesizing principles in the PATHS curriculum. After an introductory discussion of the concept of “sequencing” as it applies to curriculum development, it proceeds to a more detailed discussion of sequencing strategies in the affective learning domain. Then, using the PATHS program as exemplary case for analysis, it derives a set of guidelines for emotional literacy curriculum sequencing strategies, and explores their further implications for the design and development of the emotional literacy curriculum. Although the above research has dealt with only one dimension of affective learning, that of emotional development, the results also begin to illuminate the unique complexity and potential for further development of the topic of sequencing in affective learning. Affective learning is indeed a fuzzy subject, and has not yet received a clear and fully satisfactory definition. However, it is to be hoped that this author’s efforts and tentative conclusions will cast sufficient light for the beginning of an extended process of disclosure concerning the issues involved with the sequencing of affective learning.

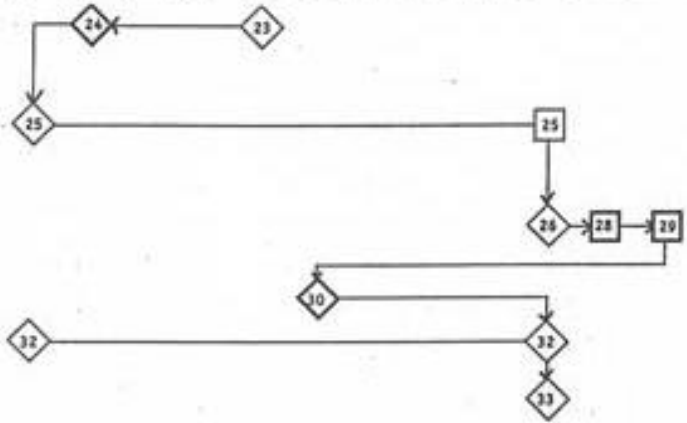
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F E E L I N G    E N J O Y M E N T    S A D N E S S    P R I V A T E    F I N E    A N G E R    F E A R    S U R P R I S E    L O V E    D I S G U S T    S H A M E    I N T E R E S T    C O N F U S E D    O B S E R V E    J A L T E R N I T Y    H A N N E R    C H E A L G I E N G    J E A L O U S    S E L F I S H



Level 1



Level 2

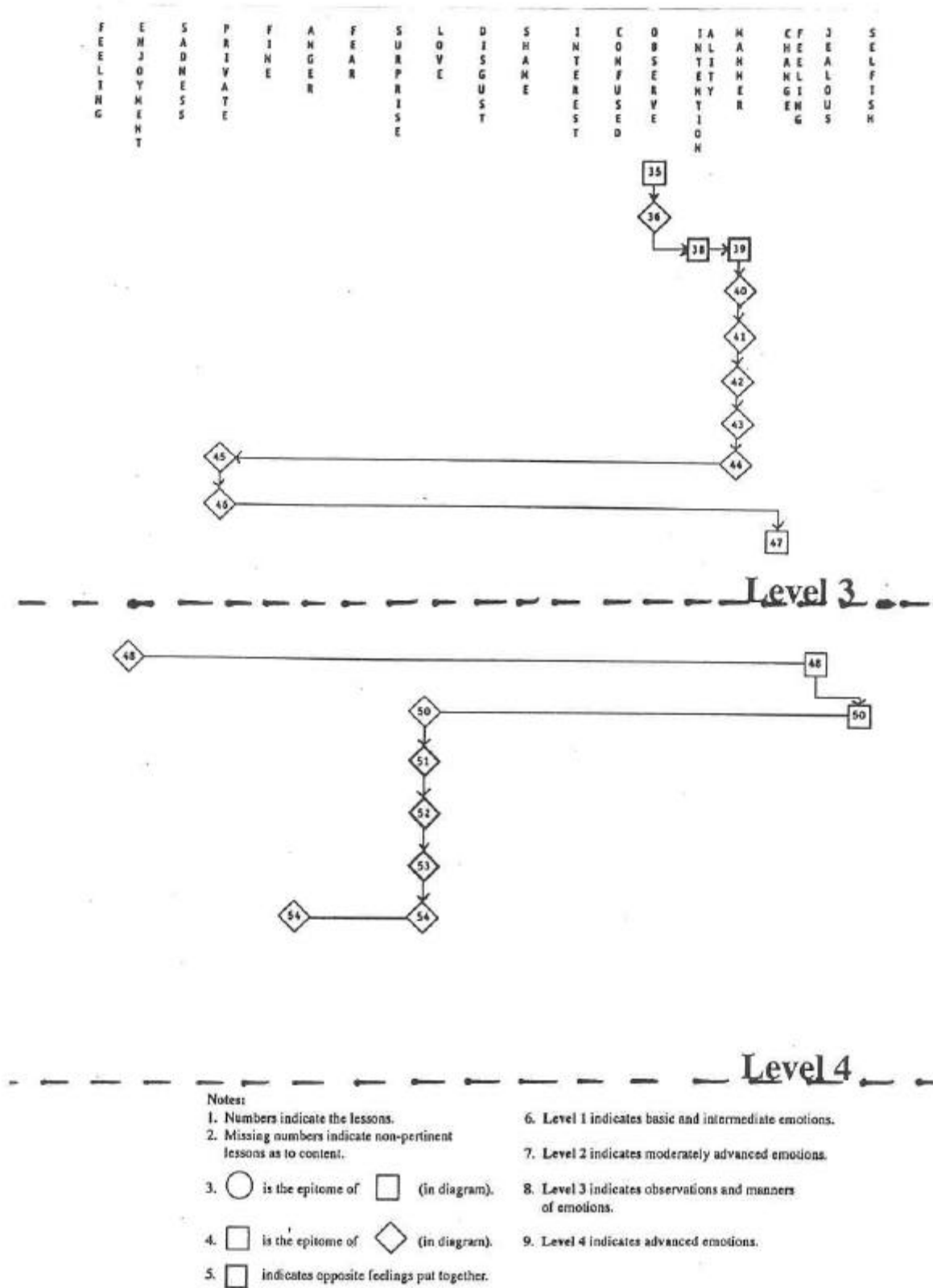


Fig. 7. Flowchart of lesson ordering in feelings and relationship units

# **SIMPLIFY WEB DEVELOPMENT FOR FACULTY AND PROMOTE INSTRUCTIONAL DESIGN**

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Faculty members are often overwhelmed with the prospect of implementing web-based instruction. In an effort to simplify the process and incorporate some basic instructional design elements, the Ed Tech Team at Embry Riddle Aeronautical University created a course template for WebCT. Utilizing rapid prototyping, the template incorporates a standardized user interface tested by students and faculty, institutional branding, structured organization, page starter templates, and online support materials.

Faculty development in the use of web based instruction is always a challenge. That challenge is multiplied exponentially when those faculty members are widely disbursed geographically. Embry Riddle Aeronautical University is unique not only in its aviation emphasis, but also in its world wide educational presence. This paper discusses the implementation of a course template to help simplify the web development process for faculty and the corresponding training issues for the Educational Technology Team.

## **University Profile**

Founded only 22 years after the historic flight at Kitty Hawk, Embry-Riddle Aeronautical University has achieved recognition as a world leader in aviation. Each year thousands of graduates take their place in the aviation/aerospace industry as pilots, aviation managers, aerospace engineers, and other aviation professionals.

ERAU is unique not only as a pioneer in aviation, but also as a pioneer in distance education. The University has three campuses: two traditional residential campuses in Daytona Beach, FL and Prescott, AZ and an Extended Campus that is literally worldwide. The Extended Campus offers traditional courses in 120 education centers located around the world and independent study courses to students worldwide.

## **Instructional Technology Implementation**

Because of its importance to aviation, ERAU has placed a high priority on technology implementation. For that reason, faculty members are highly motivated to make use of the web in their classes. Faculty at the residential campuses and Extended Campus education centers use the web to enhance their traditional classes. As such they need to learn how to use the web for everything from posting syllabi to electronic discussions and online testing. The independent studies courses also make use of the web to supplement and replace the traditional paper study guides and videotapes.

## **The Challenge**

Providing faculty with the instructional technology training and support they need to utilize the web in their courses is always a challenge. At ERAU that challenge is multiplied a hundred times plus because of the 125 Extended Campus centers and the two residential campuses. The task of training 3500 faculty members is challenging enough, but when they are disbursed geographically over 127 sites the challenge becomes monumental.

## **Course Template**

To help meet that challenge, the Educational Technology Team at the university implemented a course template for WebCT. The rationale for the template stemmed from the nearly universal reaction by faculty of being overwhelmed by the web course development process and the general failure to

incorporate instructional design into the development process. It was thought that a course template would simplify the development process by providing a standardized user interface, a structured organization, and page starter templates. In addition, good instructional design could be incorporated and encouraged.

### **The Template Development Process**

Because of limited time and resources, a rapid prototyping approach was utilized. Existing courses were reviewed to determine what web components were being used and how they were being used. Students were surveyed regarding the usefulness of web components in their courses. From that data, faculty members who use the web were presented with several alternative web course organizational structures. They were asked for input regarding the organization and the comprehensiveness of the elements that were included. Students were then presented with several alternative user interfaces and input was collected. From the faculty and student input the alternatives were narrowed and reviewed again. A final version was determined and field-tested.

### **Template Components**

The user interface involved the "look and feel" of the template, the elements available in the template, and the organization and structure of those elements. An important aspect of the "look and feel" was to incorporate institutional branding through the use of appropriate graphic elements. The template includes all the elements available in WebCT even though most faculty members do not use all of them. However, while all the elements are included, they are hidden from students initially requiring faculty to make a conscious decision to make them available to students. The organizational structure was developed to provide logical, efficient access to the various components.

To help jump start the development process; page templates were created for standard items such as the syllabus. The page templates are HTML files that contain a page structure with general information that can be edited by faculty members. Instructions are provided for downloading the pages, editing them, and uploading them. The inclusion of the page templates also made it possible to establish links from the course template to the HTML files for the various elements eliminating the need for faculty to create them.

Various instructional design elements were also incorporated into the template. The user interface incorporated graphic, layout, and organizational principles. The page templates incorporated page and message design principles. The primary encouragement towards instructional design elements was in the learning activity modules. Each module contained a preformatted page template for introduction, activities, conclusion, and suggestions pages. Links were provided in those pages to a site with additional information explaining the instructional design techniques that should be considered.

The template also includes a guide for faculty members on what is in the template and how to use it. In addition, there is an online, facilitated course that takes the participants through the complete course development process step-by-step. At key points, they are asked to submit portions of their work for review and feedback.

### **Implementation**

All new WebCT courses are created using the template. Faculty members are not required to use the template. They can modify it or eliminate it and create their own. However, the template provides a starting point, especially for new faculty members.

### **Conclusion**

A well-designed course template can simplify the development process for faculty members. It helps them focus on the instructional elements by not requiring them to make decisions about user interface and organization. It also provides them with a starting point for developing their content. The course template has helped the ERAU Ed Tech Team meet the challenge of helping faculty utilize the web for instruction.

# THE AGONY AND ECSTASY OF DIGITIZING A DEPARTMENT'S FACULTY

Kenneth A. Job  
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## How It All Started

*Over a year ago the ICL department's faculty began to express their concerns regarding the lack of technology usage in the classroom. These concerns did not related to student usage, as you would expect, but to the faculty themselves. Of particular interest was how the Internet was or was not being used to enhance instruction. Though the students are required to use various forms of technology in their class work, faculty involvement was often limited. Dr. Dennie Smith, Chair of the Instruction and Curriculum Leadership (ICL) department spearheaded the faculty's wish to increase technology usage. Though the cooperative efforts of the ICL department and the faculty of the Instructional Design and Technology (ID&T) program three major tasks were determined to improve Internet usage by the faculty.*

## The Tasks

- ☐ Update and enhance the current ICL web site.
- ☐ Have all members of the ICL department create and maintain an individual web page with only minimal future support.
- ☐ Involve faculty in the creation of on-line courses.

In this paper each of these three tasks are explained in the context of; what was done to achieve the task, how the faculty were involved, and what insights were found during the project.

### Task I - Update and enhance the current ICL web site.

## What We Did

The original ICL web site had been created several years ago, with updates being limited to just contextual changes. It was decided that the site should be reviewed and enhanced to bring it in line with more recent web site designs. Though the general appearance was to stay similar the graphics, navigation, and features of the site were to be changed. Most important was a complete review of the content of the site. Many of the text elements were outdated and in need of change, in order to reflect the latest advancements in the various ICL programs of study. The faculty also requested an expansion of the site to include; a current events calendar and on-line forms for student and faculty use.

## Faculty Involvement

Once a course was determined, the project was explained to the faculty during a general staff meeting. The ICL chair impressed upon the faculty, the need to be more technologically active and how involvement in the project would be beneficial to the whole department. The faculty were asked to cooperate in the project in order to best resolve the concerns that they and the public have expressed. It was decided to select a graduate assistant (GA), who was also a doctoral student, from within the department to help coordinate the project tasks and work directly with the faculty. This person was initially introduced at that first staff meeting. Later a contact information sheet was distributed to the faculty explaining the tasks and how to contact this GA.

The first step to updating the content was to meet with each of program chairs informally. Each program; Elementary Education, Special Education, Secondary Education, Reading, Early Childhood Education, and Instructional Design & Technology had to be reviewed and the cooperation of the faculty was essential. Once informal contact was established and they understood what was required, expanded (easy to edit) copies of the web site content were distributed.

The content was reviewed by the faculty and return to the GA within 2-3 weeks on an average. The mechanical updating of the web site was completed two weeks later. The major updates and enhancements to the site were complete by the end of the first semester. Minor updates are being continued each semester as need arises.

## **Conclusions**

Two factors were found to be of benefit in completing Task I. First, was the initial informal meeting with the program chairs. The faculty felt this meeting made them a part of the project process. That, their opinions were of value and they were going to have an impact on how the web site represented their program. Secondly, the use of expanded paper copies of the web site pages were helpful to the faculty. Instead trying to edit directly from the computer screen or use straight printed copies of the site pages, expanded versions of the pages were given to the faculty. Each web page was increased in size and given extra blank spacing for easy editing. It was necessary to explain why the expanded version was so much larger then the screen version. Once the faculty understood that it was strictly to ease the editing process and that the computer screen would look like a typical web page they found the expanded format easy to use.

## **Task II - Have all members of the ICL department create and maintain an individual web page with only minimal future support.**

### **What We Did**

This particular aspect of the project would be implemented over a two semester time period. During the first semester the goal was to have every faculty member of the ICL department create a personalized home page. The second semester would be used for enhancing their home pages and providing refresher instruction. The intention was that by the end of the second semester not only would all the faculty have home pages, but they would be able to maintain them with only minimal support.

### **Contacting the Faculty**

Four stages were used to contact the faculty in order to schedule meetings for creation of their home page.

- During a faculty meeting the task was explained and the need to schedule meetings was explained. (0% response by faculty)
- A flyer containing background information on the project and contact information about the GA coordinator was sent all faculty. (20% faculty response)
- A scheduling sheet, with a series of meeting dates, was sent those who had not responded. (an increase to 80% response)
- Person - to - person scheduling, where the GA coordinator met with faculty and asked for a meeting time. (100% response by faculty)

### **Conclusions on Contacting the Faculty**

It should be noted that between stages two and three, part of the reason for such a large increase in faculty responses was due to word of mouth. As soon as a faculty member requested a meeting they were scheduled for the earliest possible time. Once these first sessions were finished the faculty responded with praise for the work being done. As more faculty completed a session the word spread around the department and generated more interest. A second factor in scheduling was the flexibility of meeting times. When dealing with an audience like a university's faculty, who have very limited time, it was found that a wide range of meeting times was responded to favorably. Meetings could be scheduled from 8-6, M-F. Also, understanding the possible need to rescheduling with little notice needed to be considered.

### **Instruction on Creating, Editing and Publishing Web Pages.**

Prior to meeting the faculty a series of decisions needed to be made regarding the instruction to take place.



First, what approach to use for the instruction. Would it be One-on-One, Small / Large Group Instruction, and/or Instructional Handouts. Prior experiences using groups or handouts on campus had led to limited success, so it was decided to focus on a one-on-one approach to the instruction.

Second, was what type of software to use in creating web pages. It was decided to use Netscape's Composer for the following reasons. The university has established Netscape's software as a standard for all campus computers. Because of this no software had to be purchased or installed. The faculty would have everything they needed already on their system. Netscape's Composer component works very similar to a word processor. All members of the department have had some experience with word processing. Composer uses not HTML coding. A very positive response was expressed by the faculty to this news. Several had taken classes or had heard of HTML and disliked the idea of having to learn it.

Third, setting a time limit of 2-3 hours of instruction. Though the actual instruction times varied from 1 to 5 hours, every attempt was made to limit the instruction time for improved retention.


Fourth, was the instructional approach. Since part of the task's goal was to have the faculty maintain their pages with minimal support the following approach was used.

1. Use of pre-created template pages for a basic backbone structure, that could be expanded on.
2. The faculty member was put in the driver's seat. The instructor provided verbal instructions and avoided taking control of the mouse.
3. Repetition of key construction steps were stressed throughout the instruction. For example, the creation of e-mail links occurred three times and on three different pages.
4. Instructional fading was used as part of the learning process. As each successive repetition of a key construction step was repeated, the verbal cueing was decreased, until the faculty member was prompted to try the step alone. Reassurance was given prior this final step by restating the fact that they would be warned if something was about to go wrong.
5. Limited handouts were given, typically in the form of a 1-2 pages only. The faculty were encouraged to take their own notes.
6. Faculty were told that continued support would be available after instruction and at the convenience of the faculty.

Fifth, was determining just what was to be taught during the instructional sessions.

10. Creation and manipulation of text. Included: fonts, color, size, styles, indenting, alignment, spell checking, and use of special characters.
11. Insertion and manipulation of graphics. Included: resizing, wrapping text around graphics, and borders
12. Creation of links. Including: e-mail, page-to-page, and page-to-web site links.
13. Creation and manipulation of tables. Creation of table was often left until the second semester of instruction, unless specifically requested by the faculty.
14. Publishing final pages to the university mainframe.

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*Figure 1. Example of Faculty Home Page*

## What We are Doing in Second Semester

The second semester of the project was focused on refresher instruction for updating faculty web pages. Individual sessions are being scheduled using the same methods used in the first semester.

### Current Status

5. 15% of the faculty have updated their pages with no assistance.
6. 5% of the faculty have updated their pages with minimal assistance.
7. 45% have scheduled or at least requested assistance.
8. By the end of this semester all faculty pages are expected to be updated.

### Conclusions on Web Page Instruction

The faculty responded very favorable to the one-on-one instruction and stated they found it of more value than previous instructional sessions. They also felt that by using this method of instruction more was learned and would be retained. The absence of learning HTML code was greatly appreciated. The second semester seems to be going as well as the first. So far all faculty feedback has been positive and it is expected that all of their web pages will be updated and/or expanded within the time frame.

## Task III - Involve faculty in the creation of on-line courses.

### What We Did

Using similar contact methods from Task II each of the department's faculty was contacted and asked if they had an interest in on-line course development. Using this list of interested faculty we began to instruct them in using CourseInfo. CourseInfo is an Internet based shell program, that allows for creation of on-line course using a relatively easy program. Currently the university is using CourseInfo for course creation, however some interest has been expressed regarding WebCT, another on-line course creation program. The instructional methods were similar to those used in Task II. Continued support has been provided to faculty to expand usage of the program.

## CourseInfo and WebCT Capabilities

Some of the major features of these programs include:

- General display of textual information, like; a syllabus, instructors vitas, class handouts, and assignment materials.
- Bulletin boards
- Chat rooms
- Web page creators
- E-mail
- On-line testing
- Grouping organizers

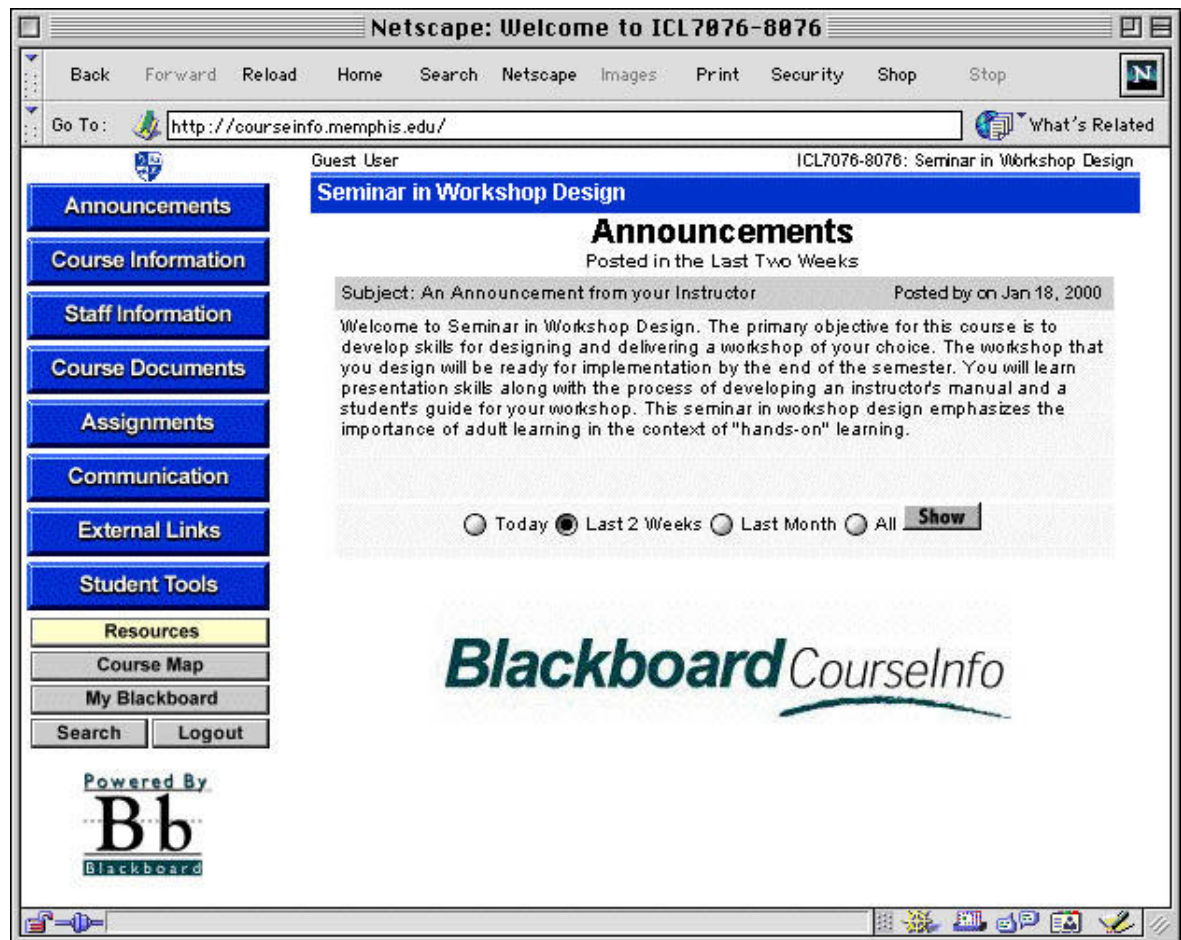


Figure 2. Example of CourseInfo Main Screen

## Involvement of Faculty in the Creation of On-line Courses

### Current Status

- ☐ 15% of faculty are currently using the software for on-line courses.
- ☐ Initially only 5% expressed any interest in learning an on-line course program.
- ☐ An additional 10% have express interest or are currently being instructed on the program.

- ☐ By the end of the second semester of the project, we plan to have 50% of the faculty using the on-line course program.
- ☐ Small and Large group workshops are also being offered at the university on creating on-line courses.

### **Conclusions Regarding On-line courses**

The faculty have found on-line courses to be beneficial for the following reasons.

- The consistency of instructional materials.
- Reduction in duplicating materials.
- Increase in active participation of students.
- Promoting self-reliance among the students.
- A new dimensions to the class instruction instead of straight lecture.

In regards to the instructional method used, it should be noted that the faculty found the one-on-one instruction enabled them to learn the software program better than group sessions. However, the group sessions allowed them to express their concerns regarding the broader issues of on-line instruction among their peers. Regardless, the number of faculty interested in trying the on-line course format is increasing each semester.

### **Conclusion**

Overall the experience of working with the faculty to improve their use of technology in the classroom has been positive. Within one year the entire department has established a web presence and nearly half have moved onto the more advanced usage of technology over the Internet. As more of the faculty become aware of the benefits, this technology can bring to the classroom, the greater the number will want to utilize it in their instruction. It is predicted that by the Summer of 2001, 80% or higher of the faculty will be using this Internet technology in their classroom.

**ICL Home Page:** [http://www.people.memphis.edu/~coe\\_icl/](http://www.people.memphis.edu/~coe_icl/)

# THE ABC'S OF ON-LINE COURSE DESIGN

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## Abstract

*During the 1997-8 academic year, 66% of the nation's 2-year and 4-year postsecondary education institutions offered distance education courses, and another 20% planned to start offering such courses (primarily via the Internet) by 2001. Currently, at least 45% of these institutions offer full college courses via the Internet. Within 20 years, on-line classes with as many as 1,000 students will replace traditional lecture courses. Distance learning is poised for a 33% annual growth over the next several years. The number of college students enrolled in distance-learning courses will reach 2.2 million in 2002. By 2002, 85% of two- and four-year colleges will offer distance-learning courses. On-line course design and facilitation is still uncharted territory for many faculty. To ensure that web-based courses are adequately developed and facilitated, we must carefully critique them. This paper presents a checklist of 25 course design principals faculty can use to critique or evaluate their on-line course sites prior to launch.*

## Running head: On-line Course Design

Web-based (on-line) courses are innovative approaches to distance education, where the learning and teaching process takes place via the technologies and methodologies of the World Wide Web, rather than the traditional classroom. Whether around the corner from campus or even around the world from it, an increasing number of college students are registering for classes that no longer meet in a predetermined space (e.g., a lecture hall) and time. These classes are meeting at a "distance" from the brick and mortar university campus.

Both historically and currently, the terms "distance education" or "distance learning" are applied interchangeably by many different researchers and practitioners in a great variety of settings and global locations. "Its hallmarks are the separation of teacher and learner in space and/or time, the discretionary control of learning by the student rather than the distant instructor, and noncontiguous communication between student and teacher, mediated by print or some form of technology" (Sherry, 1996).

According to a report by the National Center For Education Statistics (NCES) (1999) which collected information during the 12-month 1997-98 academic year, 66% of the nation's 2-year and 4-year postsecondary education institutions offered distance education courses, and another 20% of the institutions planned to start offering such courses within the next three years. There were an estimated 1,661,100 enrollments in all distance education courses, and 1,363,670 enrollments in college-level, credit-granting distance education courses, with most of these at the undergraduate level.

For the purposes of the NCES study, distance education refers to "education or training courses delivered to remote (off-campus) location(s) via audio, video (live or prerecorded), or computer technologies, including both synchronous and asynchronous instruction" (1999). The distance education technologies included video (two-way video with two-way audio, one-way live video, and one-way prerecorded video), audio (two-way audio transmission and one-way audio transmission), and Internet-based technologies (Internet courses using synchronous computer-based instruction such as interactive computer conferencing, and Internet courses using asynchronous computer-based instruction such as e-mail, listserves, and web-based courses). Of the institutions offering and/or planning to offer distance education in the next three years, the technology of choice was Internet-based technologies. This finding<sup>5</sup> suggests that Internet technologies will be a growing mode of delivery among postsecondary institutions<sup>5</sup>.

Another indicator of the growth of on-line Internet courses comes from forecaster William A. Draves of the Learning Resources Network, a distance learning industry group. According to Draves, within 20 years, on-line classes with as many as 1,000 students will replace traditional lecture courses on campus (Carneval, 2000). He also believes that universities should slash tuition for on-line courses to about \$100 to increase access to those in lower income brackets. He does not believe that on-line education

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<sup>5</sup> Higher education institutions are a subset of postsecondary.

will drive traditional education out of business, rather it will replace most lecture-based courses on campus. Traditional classes will cater mostly to small-group discussions.

Growth is also predicted by the International Data Corporations (IDC). "Distance learning, where student and teacher are connected by technology rather than participating in a classroom, is becoming a viable option to traditional teaching methods, and is poised for major growth [33% annually] over the next several years" (IDC, 2000). According to IDC's research, the number of college students enrolled in distance-learning courses will reach 2.2 million in 2002, up from 710,000 in 1998. The number of higher education institutions offering distance-learning programs is also growing dramatically. According to the IDC, by 2002, 85% of two-year colleges will be offering distance-learning courses, up from 58 percent in 1998. Eighty-four percent of four-year colleges will be offering distance-learning courses in 2002, up from 62% in 1998.

Despite the established base of on-line courses, on-line course design and facilitation is still uncharted territory for many college and university faculty. Many faculty members struggle with how to successfully use the available tools and technologies to organize instructional content into well-crafted teaching systems that support learning. Integrating technology into instruction remains the single most important information technology challenge confronting American colleges and universities over the next two to three years, according to data from the Campus Computing Project (1999), a national survey of information technology in US higher education. Thirty-nine percent of the institutions participating in the survey identify instructional integration as their single most significant instructional technology (IT) challenge, up from 33.2% in 1998 and 29.6% in 1997. While its been nearly a quarter of a century since the appearance of the first desktop computers on college campuses, the major challenges involve human factors – assisting students and faculty to make effective use of new technologies in ways that support teaching, learning, instruction and scholarship. Fortunately, most campuses have IT development programs (74.5%) and campus support centers (66.6%) to assist faculty in bringing technology resources into their courses. However, the report does not indicate the extent to which faculty actually avail themselves of this assistance and support.

In spite of the apparent learning curve, higher education's interest in using the Internet to provide instruction and courses steadily increases. According to the Campus Computing Project survey (1999), since 1998, the percentage of all college courses making use of electronic mail or Web resources increased 5% to 53.4% and 38.6% respectively. Twenty-eight percent of college faculty utilizes a course web page. Forty-five percent of the participants in the 1999 survey report that their institution currently offers one or more full college courses online via the Internet and the World Wide Web.

Clearly, distance education technologies -- and specifically on-line college courses -- are expanding at an extremely rapid rate. Far too often, college faculty become enamored with these technologies, and are quick to make available web-based courses (or web-enhanced traditional courses). They do so without adequately addressing the design, infrastructure or substance of their course sites, much less other underlying issues such as the new roles of teacher, site facilitator, and student in the distance learning process. Perhaps this is due to the proliferation of tools (e.g., FrontPage, Blackboard/CourseInfo) which dramatically decrease the time and effort required to create and publish web documents. Unfortunately, quick development time does not guarantee a well-crafted course site.

## **Course Design Principals**

To ensure that web-based courses are adequately developed and facilitated in a manner that will secure and maintain student interest, motivation, satisfaction and success, we must carefully critique them prior to actually going "live". This paper will present a checklist of factors faculty can use to critique or evaluate their on-line course sites prior to launch.

### ***Authority***

Look at your web resources (e.g., links to other web sites) with a critical eye. What is the basis of the authors' authority? That is, how have they established themselves as someone with legitimate expertise in whatever area their website is about? You should first consider if the author is a well-regarded name that you recognize. If not, then you should check to see if the on-line document has some kind of bibliography, that is, a list of references used to develop the information. Next, look for the author's biography, if there is one. Is the author affiliated with an educational institution, research laboratory, governmental agency, or other reputable organization related to the topic of the document? Finally, consider e-mailing the author and tactfully ask them how they came to be an "authority" on the topic.

### ***Bias***

Bias applies to two situations here. First, make sure your text and graphics are not biased or insensitive. Are there indications of gender or racial biases and stereotyping in text or graphics? You also want to check for bias in your included web resources. Information is biased when it provides only one opinion or point of view. It is not uncommon for a web search on a particular term (such as multimedia development) to result in hundreds of “hits” consisting primarily of commercial sites or other for-profit entities. Rather than providing unbiased information – what you expect from, say, an encyclopedia – they provide words that try to persuade (e.g., advice) or sell. Check to see what organization is sponsoring the page, and follow the link to that organization if there is one. Finally, check to see if the page is actually an advertisement or opinion thinly disguised as a scholarly source of information. Many commercial sites include “white papers” or case studies that appear to be unbiased research studies, but only serve to increase sales of their product.

### ***Citations***

Have you included full citations, and in the proper format? If you post a document, such as a scanned journal article, be sure to include a full citation. See <http://www.apa.org/journals/webref.html> for the APA’s recommended electronic reference formats.

### ***Dates***

Every credible web site includes the date it was created and the date of the last update. Also consider the date (age) of your web-resources and other posted information. Naturally, it should be current, however, you should avoid discarding seminal works just because they have an “older” publication date.

### ***Error messages***

If an error occurs, learners should be informed what the error is, why it occurred and what they can do to fix it. Communicate in the user's vocabulary. It is a good idea to utilize server software that allows you to customize the error messages. For example, if an on-line learner at Okanagan University College (<http://www.onlinecourses.ouc.bc.ca/>) mistypes his/her log-on ID, the error messages reads:

“This server could not verify that you are authorized to access. Typical causes of this are you misspelled your LoginID or password, you used spaces or punctuation in your LoginID or Password, you entered your LoginID or Password in the wrong case (upper or lower) or in mixed case, you clicked on the wrong course or the wrong section of your course. Return to the Course List and try again.”

### ***Frames***

Frames can be great for separating navigation components from content. Are your frames neatly arranged, or do they muck up the screen, potentially confusing the learner? Depending on which course management system you utilize, such as Blackboard/CourseInfo, you may have no choice about using frames, and likewise, an inability to provide a no-frames version of your site.

### ***Graphics***

Have you chosen the proper format for your graphics? The best rule of thumb is to use JPEG for pictures (i.e., photos) and GIF for graphics, charts, clip art, etc. Also, do not save your images with more than 256 colors and 75 DPI. Set graphics to interlacing such that they become more focused as they load. This gives the learner something to watch and is less likely to become impatient with a slow download. Finally, provide an alternative text that appears while an image is loading, when the ‘show images’ option on the browser is turned off, and in text-only browsers.

### ***Help***

Is “help” available for those requiring it? While we strive to create web sites that are intuitive and user friendly, we should still provide assistance for those whom require it. Include access to help on how to use the site. The help should explain what all the features, buttons, and sections of the site are. Frequently asked questions (FAQs) are valuable as well. If you have a help section or a FAQ, consider how helpful it really is.

### ***Icons***

An icon is a symbol or graphical representation of a concept, such as an image of a house representing the home page. Do the icons clearly represent what is intended to others beside you? Make sure your icons are consistent, well defined, and comprehensible (across cultures).

### ***Join***

Have you provided information on how interested students can join your class? Provide specific detail on the enrollment and registration process. Occasionally, web surfers will locate your class and want to join it; even if they are not enrolled at your university.

### ***Keeping records***

Does your site keep records of student performance? Whether records are kept in a student accessible online grade-book, or quiz scores are automatically e-mailed to you, check the functionality of these features.

### ***Links***

Check your site for links that are outdated, gone, or simply inaccurate. Are all the links clearly visible, accurately labeled and understandable? You should check your site at least once per semester for unreliable links, or what is called 'link-rot'. A reliable link, on the other hand, is up-to-date, active and does not reference a site that has moved (with no indication of the new URL). Be sure to inform learners when clicking on a link will 'surf' them off the course site to a separate website, rather than to another page on the course site. Links to documents and files should be annotated, informing learners of the type of file or information they are linking to (e.g., video, sound, text, etc.). Finally, check all links on the site for relevance and appropriateness.

### ***Multimedia***

Does the use of animation, video or audio clips contribute to the understanding of the information? Given bandwidth constraints and limitations, make sure any media you embed is really necessary. Music playing in the background of the home page is probably a 'bell & whistles' you can do without. Is file size information included for all downloadable media clips (e.g., [combustion.avi](#) [947k])? Finally, if you include streaming media on your site, be sure to either offer learners the means to choose connection speed (e.g., 28.8K, 56K, T1), or stream your media at a low data rate. This will enable those with low connection speeds to view your content.

### ***Navigation***

Learners should always be informed where they are within the hierarchy of pages on the course site, and how to get to their next destination. Check that all of the locations (e.g., pages) within the site are labeled. Have you provided clear, simple ways to get to other parts of your site? Learners will find navigation links, site maps, search mechanisms, indices and table of contents quite useful. Your first task is to provide navigation control on every page. Don't rely solely on the navigation controls in the browser. Does each page provide a way to return to the home page? Check the number of steps required for navigating from one place to another. It should be kept to a minimum. Check the length of your pages. If scrolling is necessary to read a single page (as you might expect if you placed an entire 500-line syllabus on one page), provide links within the long pages by using targets. Try to keep your navigation hierarchy as flat as practical. There should be no more than five levels and preferably fewer than three. Check for dead-ends, which are links to destinations that provide no means to return back. Finally, be sure to indicate the distance and placement of the learner within instructional sequences (e.g., page 5 of 15, page 6 of 15, etc.).

### ***Organization***

Are your online documents and other information well organized? Course management systems such as Blackboard/CourseInfo impose some organization upon you, with an area for announcements, an area for assignments, etc. The goal is to keep related information grouped in an orderly fashion. For example, one natural approach is to place different information (e.g., office hours, reading list) on separate pages, and to use proper headings within pages.

### ***Printing***

Learners may want to print all or some of your web pages. Some information is appropriate for printing and some is not. For example, a page designed to present streaming audio or video cannot be printed in a meaningful fashion because the data are not amenable to the print medium. On the other hand, text that users may want to keep as reference material is appropriate for printing. If students will want to print the web pages, which is highly likely, design them such that they format well in printed and on-screen form. To do this, be mindful of page width and length. To facilitate printing multiple pages as a collection, you should provide a means for them to do so. Simply supply a link to one long page that is comprised of all the text from the course site. This way, the print command can be issued just once.

### ***Quick & dirty***

"Quick & dirty" means cheaply made or done, or of inferior quality. Does your site look quick & dirty? Does it appear as if you created it one hour before the arrival of your first online student? Carefully check your site for misspellings, improper diction and syntax, missing data (e.g., graphics), etc.



### ***Required plug-ins***

If Java, ActiveX extensions, or plug-ins are employed, do they actually improve the site? Make sure required plug-ins or other helper applications are clearly identified, preferably right on the homepage.

### ***Structure***

Structure refers to the arrangement and organization of the elements of the course site, and the relationship of those parts to each other. In other words, how well is your site constructed? Do your web pages follow good graphic and message design principles? Do the graphics serve a function, or are they merely decorative? Are backgrounds or other visual elements distracting or cluttered? If there an element of creativity does it add to or detract from the document itself? Does the visual design enhance usability and understanding, or is it distracting? Make sure that essential instructions appear before interactive portions. As sure that all the parts of the site, such as a Flash animations, work. Is the site intuitive, or are parts likely to be misunderstood? Check the structure of the site for stability. Features should not disappear and reappear between visits. Any interactions that involve private information should be secure. How well do the features of the site work for learners with older browsers? The site design should be appealing to and appropriate for the intended audience. How long does it take for your pages to load? The pages should consistently load without problems; stability is important. Overall, your goal is for the design elements and features -- such as searchable databases, animations, graphics, sound files, and transitional pages -- to enhance and not hinder the accessibility and enjoyment of the site.

### ***Text***

Does the text follow basic rules of grammar, spelling, punctuation and literary composition? Is attention paid to the needs of the disabled who often require a larger font to read the materials? Is the text concise, or does it ramble on, resulting in excessive scrolling (which should be avoided anyway)? The text should be easy to read, and not cluttered by distracting graphics, fonts, and backgrounds. Check the text for sufficient contrast, and adequate print size. Is the text, such as headings, clear and descriptive, or does it use jargon meaningful only to you?

### ***User friendly***

Does the site look and feel user friendly? Is it easy to find your way around and locate a particular page from any other page? Can the learner interact in satisfying ways? The information on the site should be easy to find and easy to use. Users should be able to maneuver around the site easily. All interactive features should be explained clearly.

### ***Virus-free***

Does your course require students to download files from the site, such as executable programs or Word documents? If so, virus scan them to assure they are clean. (Authors note: I regularly receive uploaded assignments from on-line students that have viruses, especially Word documents).

### ***Who are you?***

Your site should indicate whom you are (your name), where you work (the institution with which you are affiliated), what your credentials are (position/title), and how your students can get in touch with you (e-mail address, phone number, and mailing address). If other individuals, groups, or organizations provided assistance in the creation of your course site, make sure you give credit where credit is due. Finally, if the development of the site was funded or otherwise supported by an individual, group, or organization other than you, again, say so.

### ***Xerox***

Make sure you have a back-up (a Xerox copy and disk copy) of your web pages and other on-line material and documents. In the event lightning strikes your server, do you have a back-up of your files, or will you be 'up the creek without a paddle'?

### ***Yo-yo effect***

When viewing an instructional sequence, such as steps in a process, do learners have to repeatedly return to a higher-level page before examining the next item in what seems like a logical sequence to them? Consider a lesson on the 3 to 5 steps to change a light bulb. Rather than incorporating a logical navigational structure where the learners can click on back or forward arrows to navigate through the lesson, the yo-yo effect forces them to first return to the main menu in order to select the next task. This 'up-and-down-up-and-down' should be avoided.

### ***Zero***

Now that you've reached the end, you should have zero faults with your course site!

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# THE USE OF AUDIO AND ANIMATION IN COMPUTER BASED INSTRUCTION

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## Abstract

*This study investigated the effects of audio, animation and spatial ability in a computer based instructional program for biology. The program presented instructional material via text or audio with lean text and included eight instructional sequences presented either via static illustrations or animations. High school students enrolled in a biology course were blocked by spatial ability and randomly assigned to one of four treatments (Text-Static Illustration, Audio-Static Illustration, Text-Animation, Audio-Animation). The study examined the effects of instructional mode (Text vs. Audio), illustration mode (Static Illustration vs. Animation) and spatial ability (Low vs. High) on practice and posttest achievement, attitude and time.*

*Results for practice achievement indicated that high spatial ability participants achieved more than low spatial ability participants. Similar results for posttest achievement and spatial ability were not found. Participants in the Static Illustration treatments achieved the same as participants in the Animation treatments on both the practice and posttest. Likewise, participants in the Text treatments achieved the same as participants in the Audio treatments on both the practice and posttest.*

*Findings for time-in-program and time-in-instruction indicated that participants in the Animation treatments took significantly more time than participants in the Static Illustration treatments. No time differences of any type were found for participants in the Text versus Audio treatments.*

*Implications for the design of multimedia instruction and topics for future research are included.*

## Introduction

Multimedia computer-based instruction (CBI) is increasingly used as an adjunct to traditional instruction in schools and corporations. CBI has typically incorporated text and graphics, but technology now exists which allows the easy and inexpensive inclusion of audio and animation into CBI programs. However, little research exists to support the notion that adding audio or animation to CBI improves learning.

Research in audio-text instruction is contradictory with some studies indicating that text plus audio is more effective than either alone (Enerson & Tumey, 1984; Hartman, 1961; Lauret, 1998; Menne & Menne, 1972; Nasser & McEwen, 1976). Other studies indicate that text plus audio is not more effective than either alone (Barron & Atkins, 1994; Barron & Kysilka, 1993; Barton & Dwyer, 1987; Furnham, Gunter & Green, 1990; Nugent, 1982; Rehaag & Szabo, 1995; Van Mondfrans & Travers, 1964). These contradictory results can be explained by Paivio's dual coding theory which proposed that two separate systems are involved in cognition, one for verbal information and another for image formation (Paivio, 1986). In Paivio's view, spoken and written language are both verbal information and are encoded into verbal representations (Clark & Paivio, 1991). In terms of dual coding theory, redundant audio is single channel verbal information and would not be expected to increase learning.

Audio combined with animation is a relatively new research field that evolved from research into the effective integration of text with illustrations. Some audio-animation research has found the combination an effective technique (Lee, 1996; Mayer & Anderson, 1991; Mayer & Anderson, 1992; Mayer & Moreno, 1998; Mayer & Sims, 1994; Moreno & Mayer, 1999), while other such research has not found positive results (Childress, 1995; Lee, 1997; Palmiter & Elkerton, 1993; Wilson, 1998).

The role spatial ability plays in learners' interpretation and comprehension of animated and static graphics is unclear. Some researchers have found animation beneficial to low spatial ability learners

(Blake, 1977; Hays, 1996). Other studies have found animation more beneficial to high spatial ability learners (Hegarty & Sims, 1994; Hegarty & Steinhoff, 1997; Mayer & Sims, 1994).

The present study investigated the effects of audio, animation and spatial ability utilizing a multimedia CBI program concerning a scientific process. The major independent variables were instructional mode (text versus audio), illustration mode (static versus animated) and spatial ability (low versus high).

Instructional mode consisted of two versions, text and audio. In the text version, the instruction was presented as screen text, while in the audio version, the instruction was presented as spoken words with limited screen text. The spoken words of the audio version matched the text of the text version.

There were two versions of illustration mode, static and animated. The static version consisted of a graphic depicting the process with no visual movement to show the process in operation, while the *animated version showed the process with visual movement to demonstrate the process in operation.*

*Spatial ability represented another variable in this study. All participants were classified as low or high spatial ability based on learners' scores on the Paper Folding Test (Ekstrom, French, & Harmon, 1976).*

## **Research Questions**

What is the effect of instructional mode, illustration mode and spatial ability on achievement, amount of invested mental effort and time?

Does instructional mode, illustration mode and spatial ability interact to influence achievement, amount of invested mental effort and time?

## **Method**

### **Participants**

One hundred and nine students from an urban high school biology course participated in this study. Participants were blocked by spatial ability and randomly assigned to one of four treatments (Text-Static Illustration, Audio-Static Illustration, Text-Animation, Audio-Animation).

### **Materials**

A CBI program, *The Cell Cycle*, was the primary instructional material. This CBI covered mitosis and meiosis and took 40-70 minutes to complete. The CBI was based upon the objectives and content of the biology course and included information, examples, activities, practice with feedback and review. Figure 1 shows sample instructional screens for Text-Static Illustration and Audio-Static Illustration program versions.

### **Procedures**

A spatial ability test was administered to the participants approximately one week prior to the study. Scores from all participants were ranked and median split to classify participants as high or low spatial ability. Participant assignment to each of the four treatments was counterbalanced by spatial ability. On the first day of the study, participants received instructions from the researcher and worked through the CBI program. On the second day of the study, participants completed the CBI program, an amount of invested mental effort survey and a posttest. All events occurred during normally scheduled class time.

### **Criterion Measures**

There were three criterion measures employed in this study: an amount of invested mental effort survey, practice item results and posttest scores. En-route time data was also examined.

A 3-item Likert scaled (5 point scale from Strongly Agree to Strongly Disagree) amount of invested mental effort survey was administered prior to the posttest. This survey had a reliability of 0.57. The three items were similar to those developed by Salomon (1984) and concerned the amount of effort and concentration expended by the participants as well as how well they thought they understood the material.

Achievement was measured by a 27-item posttest. The posttest included 15 selected response and 12-constructed response items with each item worth one to three points for a total of 30 possible points. The reliability of the posttest was 0.82.

The practice items were similar in form and content to the posttest and included 17 selected response and 11-constructed response items with each item worth one to three points for a total of 30 possible points. The reliability of the practice items was 0.70.

## Results

No differences in posttest achievement for instructional mode, illustration mode or spatial ability were found. The overall mean for the posttest was 17.34 (57.8%). Practice achievement differences by spatial ability were found (see Table 1). High spatial ability participants had greater achievement on practice items than low spatial ability participants. The overall mean practice score was 15.45 (51.5%).

There was a significant difference between High and Low spatial ability participants for amount of invested mental effort (see Table 2). Low spatial ability participants indicated a greater amount of invested mental effort than high spatial ability participants. The overall mean for invested mental effort was 4.04.

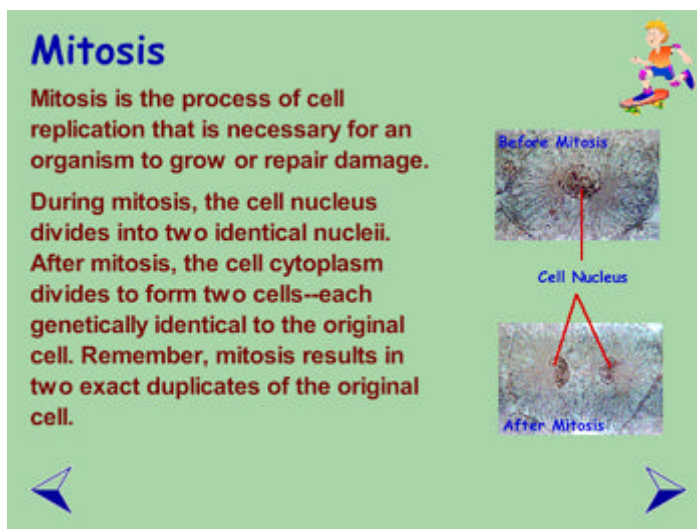
Three types of en route time data were collected. For the purposes of the study, total time-in-program was defined as the time elapsed between the participant entering and exiting the CBI program; time-in-practice was defined as the time the participants spent completing the practice items within the CBI program; and time-in-instruction was defined as the difference between total time-in-program and time-in-practice. Since the practice screens were identical in all four treatments, time-in-instruction represented the time participants spent within the treatments (Text versus Audio, Static illustration versus Animation). Time data revealed that participants spent significantly more time-in-program and time-in-instruction for illustration mode with animation taking longer than static illustration mode (see Tables 3 and 4).

Table 1. Practice Achievement Means and Standard Deviations.

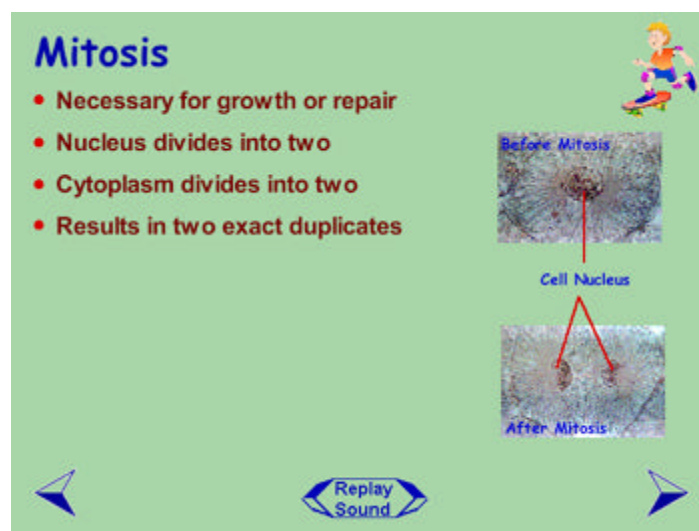
Instructional Mode			Illustration Mode			Spatial Ability		
Text			Static			Low		
<b>M</b>	<b>15.95</b>		<i>M</i>	15.59		<i>M</i>	14.41	
<i>SD</i>	4.47		<i>SD</i>	4.68		<i>SD</i>	4.54	
<i>N</i>	44		<i>N</i>	41		<b>N</b>	<b>41</b>	
<b>Audio</b>			Animation			High		
<i>M</i>	14.90		<i>M</i>	15.33		<i>M</i>	16.44	
<i>SD</i>	4.33		<i>SD</i>	4.19		<i>SD</i>	4.09	
<b>N</b>	<b>40</b>		<b>N</b>	<b>43</b>		<b>N</b>	<b>43</b>	

Table 2. Amount of Invested Mental Effort Means and Standard Deviations.

Instructional Mode			Illustration Mode			Spatial Ability		
Text			Static			Low		
<b>M</b>	<b>3.96</b>		<i>M</i>	3.98		<i>M</i>	4.21	
<i>SD</i>	0.66		<i>SD</i>	0.71		<i>SD</i>	0.58	
<i>N</i>	51		<i>N</i>	56		<b>N</b>	<b>50</b>	
<b>Audio</b>			Animation			High		
<i>M</i>	4.11		<i>M</i>	4.11		<i>M</i>	3.87	
<i>SD</i>	0.63		<i>SD</i>	0.56		<i>SD</i>	0.67	
<b>N</b>	<b>52</b>		<b>N</b>	<b>47</b>		<b>N</b>	<b>53</b>	



*Text-Static Illustration Version Instructional Screen*



*Corresponding Audio-Static Illustration Version Instructional Screen*

*Figure 1. Sample Instructional Screens for Text-Static Illustration and Audio-Static Illustration program versions.*

Table 3. Time-in-Program Means and Standard Deviations.

Instructional Mode			Illustration Mode			Spatial Ability		
Text			Static			Low		
	<b>M</b>	<b>54.46</b>	<i>M</i>	50.40		<i>M</i>	53.32	
	<i>SD</i>	10.42	<i>SD</i>	11.41		<i>SD</i>	13.05	
	<i>N</i>	44	<i>N</i>	41		<b>N</b>	<b>37</b>	
<b>Audio</b>			Animation			High		
	<i>M</i>	51.89	<i>M</i>	56.35		<i>M</i>	53.29	
	<i>SD</i>	11.38	<i>SD</i>	9.48		<i>SD</i>	8.73	
<b>N</b>	<b>36</b>		<b>N</b>	<b>39</b>		<b>N</b>	<b>43</b>	

Although the CBI program included elements of effective instruction, overall performance on both the practice and posttest was quite low (51.5% for the practice, 57.8% for the posttest). This was probably due to several factors. As with most science topics, the CBI program was heavily laden with the technical jargon necessary to understand the content. Considering the short time of the treatment, participants may have been unable to acquire the extensive vocabulary required by the material despite activities incorporated into the CBI to aid in learning and retaining this terminology. In addition, this course was the first high school science course for many of the participants and they may have had few existing science concepts with which they could relate new concepts. To be concise, the CBI covered a lot of material in a relatively short amount of time. It is possible, and indeed the overall achievement scores suggest, that more time and practice was necessary for participants to master the material.

Examination of the Amount of Invested Mental Effort (AIME) results indicated significant differences by spatial ability. Low spatial ability participants reported greater AIME than high spatial ability participants. This result can be explained by dual coding theory (Paivio, 1986). Low spatial ability participants probably spent more time and effort building visual representations than high spatial ability participants. The low spatial ability participants thus had fewer cognitive resources available for building the referential connections between the visual and verbal information in the CBI program (Mayer & Sims, 1994). Consequently, low spatial ability participants would naturally perceive they had expended a greater amount of mental effort than high spatial ability participants.

Findings for time-in-program and time-in-instruction indicated that participants in the Animation treatments took significantly more time (five to six minutes longer) than participants in the Static Illustration treatments. This difference was expected and supports Baek and Layne's (1988) finding that animations require more instructional time than static illustrations. In the current study, the eight Animated instructional sequences took 9 minutes and 20 seconds to play assuming no sequence was replayed by the participant. The corresponding eight Static Illustration instructional sequences should have required less time for the participants to complete as they need not have waited for an animation to finish before proceeding. In contrast, no difference in terms of time-in-practice was found. Participants in the Animation treatments spent the same amount of time-in-practice as participants in the Static Illustration treatments. Since the practice screens contained only static illustrations or no illustrations at all, this result was expected.

No time differences of any type were found for participants in the Text versus Audio treatments. Again, differences for time-in-practice were not anticipated since the practice screens were the same in the Text as in the Audio versions. However, the results for time-in-program and time-in-instruction are puzzling.

Participants spent the same amount of time in the Text as in the Audio treatments. Based on previous studies (Barron & Kysilka, 1993; Koroghlanian & Sullivan, 2000) and common sense, one would have expected the Audio version to take longer than the Text. Examination of data collected during CBI program development indicates that participants in the Text versions should have completed the CBI program 10 to 15 minutes sooner than those in the Audio versions. This time difference did not occur. Perhaps participants in the Text versions spent those 10 to 15 minutes rereading the text, examining the static illustration/animation or trying to integrate the text information with the static illustration/animation.

## **Implications for Instructional Design**

The results of this study supports previous research that suggests moving some text from the screen to audio neither hinders nor improves learning. This finding has important implications for multimedia development. If screen "real estate" is needed for something other than instructional text, which is especially true for simulations and concepts difficult to explain with words alone, then text can be moved from the screen to audio with no loss in achievement. This is an important and useful instructional technique for instructional designers to consider, especially when designing materials with scientific or technical content.

The implications of this study are less straightforward in terms of animation. Animation did not improve learning for this content and age group. Animation did take more instructional time than static illustrations with no corresponding improvement in achievement or difference in attitude. Whether to include animation or not in multimedia programs or CBI is still a matter of instinct, not research, and the final decision may be dictated by pragmatic concerns such as budget or time.



While this study was conducted with computer based instructional materials; the results have wider implications for multimedia instruction in general. Web based instruction, for example, increasingly incorporates multimedia attributes such as audio and animation. The incorporation of these attributes should be based on instructional design principles and research to ensure effective and efficient instruction.

## **Suggestions for Future Research**

Several avenues of future research are suggested by the findings of this study. One area that warrants further investigation is the physical combination of audio and animation. Some researchers might argue that the present study did not minimize the split attention effect and thereby did not optimize the instruction or research conditions. Future research could examine superimposing text on the illustrations and animations as well as utilizing audio only with illustrations or animations followed by text at the end of the sequence. These sequencing and layout situations would tend to minimize the split attention effect and might clarify research results and subsequent instructional design decision-making.

One puzzling and fascinating result of the present study concerns the activities and mental processes of the participants. Participants spent the same amount of time in the Text as in the Audio versions although participants in the Text version would have been expected to finish 10-15 minutes sooner than those in the Audio version. Interposing questions during the instruction or formally observing participants might provide information of use and interest to the researcher and instructional designer.

Further research into text density and structure would be valuable to instructional designers designing both traditional CBI and web-based instruction. Reducing instructional screen text while providing the majority of instruction via an audio track, is an extremely useful technique in situations of highly complex processes and simulations where there is a need to maximize screen space for non-text purposes. Research into the amount of text required when text is combined with audio and the manner in which that text should be structured and presented warrants further investigation.

Audio and animation are powerful tools for the instructional designer. Deciding when and how to use these tools is an important field of inquiry that deserves more attention and effort.

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# **VIDEO-BASED CLASSROOM LESSONS FROM DELIVERING INSTRUCTION IN AN INTERACTIVE VIDEO-BASED CLASSROOM**

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## **Abstract**

*Distance education is growing very rapidly, and one form of distance education is two-way interactive video. This qualitative pilot study presents findings from interviews conducted with instructors who taught in a new interactive video classroom. Instructor responses are condensed and summarized. Responses include instructor insights on: student perceptions; instructor skills required; teaching methods used; obstacles to overcome; and technical considerations.*

## **Lessons from Delivering Instruction In an Interactive Video-Based Classroom**

In the last few years of the 20<sup>th</sup> century institutions of higher education have moved toward delivering instruction via distance education -- the separation of the instructor and learner by time and/or location. While distance education is not a new phenomenon, the decreasing cost and subsequent ubiquity of telecommunications equipment, computers, and networks has made distance education a more attractive option. This option may appear favorable to innovative instructors, fiscally conscious administrators, and students who cannot attend a residential campus (Moore and Kearsley, 1996). The opportunity to reach new educational "markets" has encouraged higher education institutions to pursue various modes of distance delivery. One such delivery mode involves two-way interactive compressed video. This pilot study will describe instructor obstacles, insights, and lessons learned from course delivery in an interactive two-way video environment.

## **Program History and Description**

In 1998 the University of West Florida began course delivery via two-way interactive video. The University constructed two classrooms -- one at the main campus and one at a branch campus 75 miles away. These classrooms were equipped with VTEL video cameras, microphones, and telecommunications equipment to enable two-way transmission of real-time compressed video and audio signals. This system was meant to replace the practice of instructors commuting to and from the main and branch campuses for teaching, advising, and related student support services. The student population at branch campus was growing, with an increasing demand for courses and degree programs. Table 1 shows a chronology of significant developmental events.

**Table 1**

1993 UWF Instructional Technology department seeks funds for video-based classroom
1997 Main and branch classrooms constructed and connected
1998 Video-based course delivery begins
1999 Web-based course delivery begins

Each of the classrooms was entitled the Interactive Distance Learning Studio (IDLS), as a means of identifying the unique distance education environment associated with the classrooms. Table 2 shows the equipment installed in the two IDLS classrooms.

**Table 2**

Two cameras -- one focused on the instructor and one focused on the students
Large video monitor at the front of the classroom enabling the local students to see the remote students (see Figure 1)
Large video monitor at the front of the classroom displaying what the remote students were seeing (camera view) (see Figure 1)
Large video monitor at the rear of the classroom enabling the instructor to see the remote students (see Figure 2)
Desk-based microphones for each student
Microphone and camera tracking device worn by instructor
Twenty networked microcomputers



Figure 1: View of the local and remote students in the IDLS



Figure 2: View from the rear of the IDLS, showing the remote students

The initial courses offered in the IDLS were taught by the Instructional Technology (IT) department faculty. This administrative decision was based on the premise that the IT faculty would be more willing and motivated to use the telecommunications technology for course delivery. Also a facilitator was provided for each interactive video course. The facilitator supervised the remote site during each class meeting and provided technical and instructional support to the course instructor.

### Methods

This pilot study consisted of interviews with the instructors at the conclusion of the first semester of classes delivered via interactive video. The interviews were all conducted by the author, and were designed to elicit primarily qualitative information about the teaching experience. The interview questions were structured as follows:

1. What technical considerations were involved in teaching in this environment?
2. What is required of students in this environment?
3. How did the facilitator contribute to the instructional environment?
4. What teaching styles or strategies did you employ in this environment? How was this different from a conventional course?
5. What insights or recommendations can you offer to instructors teaching via interactive video?

### Results and Discussion

The following is a condensed summary of the instructor responses to the interview questions.

#### **1. What technical considerations were involved in teaching in this environment?**

In terms of technical considerations, instructors raised several issues. The need for practice and skill in addressing the camera (and therefore the remote site) was commonly mentioned. Addressing a camera while teaching was an unnatural activity and required behavior modification on the instructor's part. Similarly, interacting with remote students was a challenge. There was a perceived lack of immediacy in addressing and responding to the remote students on the video monitor, as opposed to the physically present local students. Also instructors needed training in operating and switching the cameras (from instructor to students) via the touchpad. Remembering to switch the views at appropriate times was also a challenge. Instructors had to manage and deal with possible technical difficulties with the wearable tracking microphone, the camera touchpad, the document camera, and a computer-based presentation.

#### **2. What is required of students in this environment?**

Interaction with the instructor and remote students were the key issues here. In this type of environment, students must always use the desk-mounted personal microphone for interaction with peers or

the instructor. Otherwise the remote site is excluded. This requirement often limited or silenced interaction, particularly short comments or witticisms. Short comments may be perceived as not worth making, weighed against having to wait for the instructor to recognize and get the camera switched to the student. Students had to adjust to being on camera and seeing themselves on the video monitors. Whenever a student wanted to make a comment, he or she had to be prepared for the camera to automatically turn and zoom in for a close-up. This video attention may have discouraged shy students from participating. Interacting with distant students was unnatural, and the technical and time requirements to involve remote students had the potential to create resentment with the local students.

### **3. How did the facilitator contribute to the instructional environment?**

The facilitator evidently is a very important factor in determining the quality of the experience of the remote students. It is highly desirable that the facilitator has subject matter, as well as technical expertise. The facilitator supports the remote students by clarifying parts of the instruction, distributing materials, maintaining order, and encouraging interaction. Interestingly the remote students may develop a closer affiliation with the facilitator than with the course instructor, and this must be considered. The facilitator was often a comfort to students in this new and unfamiliar environment. For remote students, the facilitator is perceived as "theirs".

### **4. What teaching styles or strategies did you employ in this environment? How was this different from a conventional course?**

Much more instructional planning was needed, including planning for any instructional materials to be available at both sites. Entire meetings needed to be scripted like a stage play, including interaction within and between sites. Some instructors perceived that they "needed to be more linear" in their lecturing style, due to the video medium. A common remark was that it was much less effective to "wing it" -- that is, deliver unplanned or less formal presentations. Many instructors indicated they questioned students by name, rather than using open-ended questioning techniques. Open-ended questions went unanswered, possibly due to reluctance of students to draw camera attention to themselves. Instructors attempted inter-location discussion and collaboration via video in class and asynchronous Web discussion outside of class. Some instructors attempted to be more entertaining, and to try a variety of teaching methods to maintain the attention of the remote students. One instructor perceived that he was less mobile (moving throughout the room) due to the limited range of the tracking instructor camera.

### **5. What insights or recommendations can you offer to instructors teaching via interactive video? The following represents summary statements from the interviewed instructors.**

- Students' disdain over seeing self on camera led to decreased participation from some students, and domination of discussion by others.
- Using student microphones destroys spontaneity. The technology suppresses jokes, clever remarks, or quick interchanges. (Is your witticism worth stopping the show?).
- There was some rivalry and potential for resentment between sites. Wherever the live instructor taught was perceived as the "main" or "favorite" group. Larger remote class size (over 10) makes interaction difficult (seeing faces, etc.)
- In unfamiliar waters it's good to appear "in command" to reduce student anxiety.
- Travel to and teach from the remote site often if possible.
- The entire class meeting must be scripted like a television show.
- Use inter-site collaboration/discussion to prevent "us vs. them" rivalries from developing.
- Less content can be covered than in a traditional class. Use the Web to continue class discussions.
- Audio and the interaction dynamics associated with it are the most important technical considerations.

- Lower-level skills may predominate (reading, memorizing) while analysis and synthesis are difficult due to discussion constraints (microphones, cameras).
- Short lectures (10 minutes) is about all the remote students will tolerate. (One instructor commented, “I’m not Tom Cruise”, meaning he was not a polished video entertainer).
- The instructor must spend adequate time during the first class meeting orienting students to the environment and requiring them to use the technology. This reinforces the required interaction conventions.
- Team teaching between sites requires even more planning, and differences between instructors can cause difficulties.



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## **DISTANCE LEARNING AND DISABILITY ACCESS: A SUCCESS**

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This paper describes a three year grant project (Federal Grant #H029A70113) at the University of Northern Colorado to design and deliver a graduate master's degree program in blindness and visual impairment to the 14-state region of the Western Interstate Commission on Higher Education (WICHE). The project, funded by the US Department of Education, began in January of 1998. The \$1.1 M grant project currently offers courses to 78 students working to complete 17 to 62 semester hours of coursework (depending on previous training and experience). Additional funds have been contributed by private and state sources. These students are geographically distributed across 18 of the United States, over half of them in states without personnel preparation programs in blindness and visual impairment. The first classes were delivered in the fall of 1998. Fourteen courses have been converted for distance delivery as part of this project. In the fall of 2000, eight courses were delivered with a total of 86 students registered.

While students who are blind and visually impaired (BVI) represent less than one-half of one percent of the school age population, they are a group of students with multiple and often complex educational needs. One of these needs is for a specialized teacher trained in the methodologies of blindness and the adaptations necessary to facilitate access to the general education curriculum. Rural school districts do not easily meet the needs of these students, in part because of the cost of hiring these specialized teachers, and in part because qualified teachers of students with visual impairments are in short supply. The shortage grows yearly (Ingersoll, 1999), as universities close teacher preparation programs that require significant investments in fiscal and human resources without producing equivalent tuition revenues.

Less than 400 new professionals in blindness and visual impairment enter the field annually (Ferrell, 1999). The teacher shortage in blindness has become so severe that the Office of Special Education Programs funded a special project to investigate the depth of the problem and to develop a national plan for meeting the personnel needs of the future. Although the results of this project have not yet been published, it appears that the nation's capacity to prepare specialized teachers is sorely stretched. Using technology to train teachers at a distance, especially in those states that do not have teacher training programs in blindness, is one way of expanding the nation's capacity while permitting students to remain in their current jobs in their home communities. For rural school districts, this may be the only way they will ever recruit a specialized teacher for their children with visual impairments. A particular challenge of this project has been to provide a quality graduate education experience for practicing educators who cannot leave the special needs populations that they currently serve to re-tool for this area of specialization.

### **Project Description**

At the culmination of the three-year funding, this project has increased the graduate admissions to the Master's program at the University of Northern Colorado (UNC) over five-fold. Graduates of the program each year now outnumber the previous cumulative graduation total for a four-year period. Seven faculty have participated in the re-design and delivery of their courses using eight different distance technologies and media. Students who are themselves BVI are participating and we have recently added an instructor who is blind and teaching from a remote state.

The BVI faculty at the UNC have a deeply held philosophy about this severe needs program. It was agreed early on that the distance delivered program would subscribe to the same philosophy and that has influenced many design and implementation decisions. The philosophy statement is:

"The UNC Severe Needs: Vision program is based on a firm and continuing commitment to the rights of all students with visual and other disabilities to receive equal educational opportunities, including equal access to the curriculum. The faculty believes that each learner should be provided educational opportunities that maximize potential for whatever level of independence is possible in order to be productive in society and to live a meaningful and fulfilling life."

This philosophy has become a guiding one in design and development decisions related to meeting the needs of our BVI students. The concept of providing "separate, but equal" access is completely contrary to this project. While it may be more difficult for the person without sight to take advantage of today's visual distance environments, this project demonstrates that there are many strategies that can be incorporated within distance learning environments to leverage the communication potential of these delivery technologies (see "Building Websites for the Blind: A Primer" in these Proceedings). A focus on collaboration, sharing, and contextualized experiences allows not just "teaching-by-telling, but learning-by doing" (Stanard, 1999, p. 49).

This project is one example of Molly Broad's comments about virtual learning, or the "fundamental importance of high-quality faculty and effective interaction, both between faculty and students and among students. Faculty rightly believe these are fundamental to good education; however, with the growing array of technology tools, it is possible to achieve those objectives online. In addition, virtual learning can also bring a very rich array of academic resources to the learning process--resources that address the multiple learning styles of students, and resources that greatly enrich the educational materials available to students" (Morrison, 1998, p. 3).

The project team consists of a Project Director and Project Coordinator who have served (along with other special education faculty) as subject matter experts, a faculty member from educational technology who has served as the primary instructional design and distance delivery consultant, and multiple graduate students from educational technology who have served as designers, developers, technical assistants, professional development coordinators, and as remote student support staff. Adequate investment in both human and technical resources is one reason the project has been successful. Enrollments are now stable enough to sustain the delivery of the distance program without additional grant funding.

The delivery of the degree program is grounded in a robust web environment that offers content, additional resources, and student support tools. Every course includes a website, threaded discussion, class listserv, and synchronous chat. Other customized components of courses include web-based interactive quizzes, case studies, multimedia tutorials, customized videotapes, and links to multiple special needs organizations. In addition, there is a web-based virtual university center (listserv, synchronous chat, bulletin board) for the students to use for communication and collaborative projects, and a threaded discussion area specifically for faculty involved in distance education efforts. The development of a sense of community for these learners and faculty has been the recent focus of project refinement and elaboration efforts through scaffolding communication and creating a sense of place for remote learners.

## **Design and Development Issues**

Instructional design (ID) issues that have influenced the project cut across a broad range.

- alignment of course content with four sets of professional standards
- special education faculty review of course objectives for overlap and update
- introduction/implementation of the ID process (generically: ADDIE for analysis, design, development, implementation, evaluation) with special education faculty
- helping discipline faculty in their reconceptualization and adaptation of traditional instructional strategies
- delivery system and media selection that are compatible with the adaptive technologies used by BVI learners (e.g., screen readers, braille keyboards) and content appropriate
- materials development with attention to the special needs of the BVI, but not to the exclusion of the creation of visually stimulating materials and environments for the sighted learners and instructors
- discipline faculty preparation and support as they teach in these mediated instructional environments
- complete revision of student assessment and evaluation to a standards- and performance-based model
- creation of student and faculty support materials

Other issues that have surfaced are related to the administration and implementation of distance learning programs.

- faculty and student access to distance technologies is not yet ubiquitous; high quality, dedicated technical support is essential
- importance of strong administrative support from the College of Education Dean
- project management requirements were underestimated (timelines, coordination, collaboration)
- the degree program is complex due to state licensure requirements and this complexity is compounded when students participate from multiple states
- the participation of non-special education faculty requires additional time and design support
- other campus support systems (e.g., Academic Technology Services, Registrar, Scheduling) must be administrative partners in such large scale efforts
- facility design was required (WWW access stations; digital video development station; compressed video classroom, access to adaptive hardware and software)
- technical considerations at the development level and the end user level (e.g., website compatibility with screen readers, software versions, Web browsers and their configuration; software downloads) must be addressed simultaneously
- remote student access to registration, library resources, textbooks, advising, financial aid, and other support services in a university environment unprepared for these requests.

## **Delivery Systems and Media**

The project purposefully employs a wide variety of distance delivery systems and media. In particular instances, materials are developed in more than one media to allow all students (sighted and non-sighted) access. Though not a stated objective of the project, an unintended consequence has been that the students are increasing their use of and comfort with technology, in general. All members of the project team believe in the power of technology to meet learner needs and in the importance of better preparing teachers to effectively utilize technology with their students. For these students who will teach children who are BVI, Hardman's (1999) comment strikes a loud chord, "A technologically competent work force in the education industry is needed to continue to keep the promise of universal education: to leave behind no child who is willing to try" (p. 4). The project relies on the WWW, compressed video (CV), text (student handbooks and coursepacks), videotape (custom and commercial), CD-ROM (custom), a required campus component during one summer, computer video conferencing, synchronous and asynchronous communication via the Web, audioconferencing, and commercial satellite downlinks.

The discipline faculty felt strongly that the distance delivered program should be as student-centered as the campus program. The design and development process has consistently incorporated Sorg and Truman's (1997) recommendations for creating quality student-centered virtual classes. Their recommendations included personalizing instruction, humanizing the course pages, providing advance organizers, and assuring easy navigation between and among course topics. During the grant period, the project website has undergone three substantial re-designs. Each one has brought us closer to the desired student-centered, interactive, facilitated distance learning environment that is our vision.

Though multiple media and distance systems are used to deliver this program, the WWW is the central learner and instructional resource for the redesign of each course (<http://vision.unco.edu/>). A standardized navigation shell was custom created so students do not feel "lost" each time they begin a new course in their program. Each course, however, relies to varying degree on the Web for the delivery of instruction. All courses have embedded syllabi, links to the four sets of discipline standards and course standards, course requirements, description of course activities, an asynchronous threaded discussion area, a synchronous discussion area, course schedule, and a place for additional resources that may or may not be web-based. Each course also has a dedicated class listserv. Some of the course websites include interactive custom-designed tutorials, samples of student projects, links to external assistive software, and multimedia authored graphics. The project website is not password protected, but all course sites are. The variety of technologies in use has increased as the discipline faculty has become more comfortable with trying new instructional strategies with remote students.

Remote students have access to several support systems that have proven invaluable to the satisfaction and success of the learners.

- online Graduate School admissions application
- student handbook for project participants (available in text and as a PDF file on the Web)
- toll-free phone into the Special Education Division office
- a Webmaster who responds to individual technical problems with near 24/7 response
- CD-ROM with web browser and style sheet options to load on home computers
- course enrollment and program enrollment listservs (subscribers include students, faculty, and the grant team)

## Lessons Learned

- Facility design of distance education learning environments (DELEs) is expensive, time consuming, and requires substantial technical, pedagogical, and academic expertise related to distance delivery of instruction.
- ID and FD (facility design) need to evolve simultaneously for DELEs that utilize multiple delivery systems/media.
- Substantial advance planning and continual project management is critical to initiatives of this scope.
- Most of the distance delivery technologies today are visual technologies; consequently there is significant attention required to specialized design and development considerations for this project and for any other distance effort that strives for equal access for disabled learners.
- Faculty introduction to and training for using these technologies for instructional purposes is particularly important to project success, learner satisfaction, and continued faculty involvement.
- Meeting individual learner needs, faculty expectations, and content requirements are not mutually exclusive in the creation of a DELE, but the process is extremely complex.

## Future Directions

Federal funding ends on December 31, 2000 and the staff have applied for additional funding to continue the project and keep up with changing technology. Our next steps include technical assistance regarding online course delivery to other universities with programs in visual impairment and blindness, as well as licensing of the courses for delivery at other universities. Discussions are also proceeding related to using this design and development effort as a model for other low incidence disability degree programs.

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## BVI Resources

Bobby <http://www.cast.org/bobby/>  
 EASI at Rochester Institute of <http://www.rit.edu/~easi>  
 Technology

"House of Style" CSS Tutorials	<a href="http://www.westciv.com/style_master/house/tutorials/index.html">http://www.westciv.com/style_master/house/tutorials/index.html</a>
IBM Accessibility Center	<a href="http://www-3.ibm.com/able/">http://www-3.ibm.com/able/</a>
Microsoft	<a href="http://www.microsoft.com/enable/">http://www.microsoft.com/enable/</a>
TRACE at University of Wisconsin-Madison	<a href="http://trace.wisc.edu/">http://trace.wisc.edu/</a>
World Wide Web Consortium's Web Accessibility Initiative (WAI)	<a href="http://www.w3c.org/WAI/">http://www.w3c.org/WAI/</a>
WWW Consortium's Synchronized Multimedia	<a href="http://www.w3.org/AudioVideo/">http://www.w3.org/AudioVideo/</a>
W3C Validation Section	<a href="http://www.w3.org/MarkUp/#validation">http://www.w3.org/MarkUp/#validation</a>

# **FACILITATING HIGHER ORDER THINKING: NEW TEACHER'S DILEMMA**

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## **Introduction**

International interest in the use of the Internet and the World Wide Web (WWW) in learning environments has become the major area of focus for many educators and instructional designers. While few dispute the value of hypermedia in instruction and training, the design, development, and implementation of web-based learning has not been researched in any exhaustive way. This paper will examine the experiences of one design and development team attempting to encourage critical thinking skills among a group of pre-service teacher education students.

One of the basic components of the course, Higher Order Thinking for Educators, a course required of all students majoring in Elementary Education, is a series of case studies. The cases introduce the students to problems faced by teachers in public schools today. The course currently employs five case studies to allow the students to examine a situation, discuss its components, and arrive at possible solutions to the scenario, based on small group discussions. The learning objective for the cases was to enable pre-service teaching students to enhance individual problem solving abilities. These students were dispersed in various locations within the state in clinical experiences and spent only limited time in class with the cases. It was hoped that the students would improve their higher-order thinking skills and problem-solving abilities if they spent more time working with the cases outside of class and then be able to transfer what they had learned to new situations in their school environments.

## **Why Case Studies**

Case studies have been used effectively to provide scenarios containing problems that exist in real life situations. Since successful decision-making is based on experience, and many students lack experience, case studies serve to simulate experiences and enable better decision-making for novices. Kowalski, Weaver, and Henson (1990) refer to case studies as "...descriptions of a decision or a problem...normally written from the perspective of the decision maker involved. ...Once they have been developed, cases are used by students as a way of putting themselves in the decision maker's or problem solver's shoes." (p. ix). According to Wasserman (1993), using cases in teaching encourages learning by insisting that learners and teachers deal with first-hand knowledge and allow students to think critically about the situation, making sense of all the parts of the case. Then, they can make a truly informed decision.

## **Why WBT?**

Considering the geographic dispersion of the students, the any time, any place nature of the web offered expanded access to the case study. It also provided an opportunity for students to self-pace their learning and think in greater depth about the situation described in the case. Students also had more time to reflect on the information they encountered and uncovered. To encourage this increased student-content interaction, the designers used digital photos of the individual players and made the scenario as believable as possible turning the case study into a simulation. Using images and text together, the team attempted to create a case whose "lessons learned" would transfer to real life. It was important that the students could identify with and put themselves in the "shoes" of the new teacher portrayed in the case.

## **The Design Team**

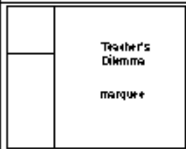
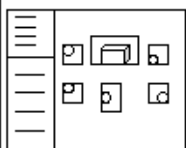
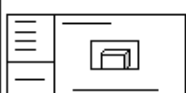
One case was selected for conversion to web-based delivery and was designed and developed by a cross-discipline team consisting of two students and four faculty members. In total the expertise of instructional designers, a content specialist, and technology experts were integrated to design and develop this unique web-based learning experience. The two instructional designers had experience conceptualizing and designing computer-based instruction and WWW applications. Additionally, each had expertise applying pedagogical theory to instructional objectives. The course instructor, who had extensive experience in problem-based learning, provided content. On the technology side of the team, both student programmers and the advising Information Systems faculty member were experienced in developing programs, especially utilizing WWW-based languages.

Initially, the team reviewed the case to make certain that all participants understood its content and the objectives for the activity and discussed ideas related to screen design and navigation. For instance, it was agreed that the online version must be creative, engaging, interactive, and utilize motion and sound where appropriate. One particularly critical activity in this initial stage was facilitating the content specialist's realization of the potential of the technology. While she had experience with case-based problem solving, she had little experience with the WWW and associated technologies. No attempt was made to determine exactly how concepts would be presented, since in this particular situation, the subject matter expert (SME) was also the client. Thus, it was imperative that we educate the client about the capabilities of web-based training before discussing issues such as video clips or animated gifs. Specifically, it was critical that she understand the nonlinear nature of the WWW and its interactive capabilities.

## Design and Develop

The storyboard (see Figure 1) was a funnel for our brainstorming sessions. Capturing the essence of these sessions, we developed a board. In addition, we adapted a typical storyboarding situation to capture the transformation of the written case to a proposed screen design and related actions. The left side of the storyboard frame is a textual excerpt from the actual case. The center column of the board represents the proposed screen design, encompassing both graphics and text. On the final and right board are actions to be integrated into the design.

Figure 1. Storyboard

Case	Screen	Action
		Title screen with running marquee. Left frame - menu links. "Credits" link goes to Development Team. "Instructions" goes to instructions, and "Case Study" goes to Background.
Background There are several characters appearing in this case, so perhaps we should learn a little about them before we begin. Click on a picture below to review background information.		Lower left menu bar allows user to access any part of the case non linearly. Scrolls down to allow 11 selections. Background screen in main frame provides links from each name or picture to document about that character. When a picture is clicked, goes to that character's background information.
Jefferson Elementary School is in Liverton, a medium-sized city in the Northeast with a diverse population of about 85,000. The school district serves about 8,000 students		A header describes the subject, followed by the image, and then the information which may or may not be relevant to the case. An arrow at the bottom of the

Storyboarding and graphic representations of instructional screens and site maps flowed out of brainstorming sessions and into the prototype product. Using various tools for this project such as Asymetrix® ToolBook, Hypertext Markup Language (HTML), JavaScript™, and JAVA™ applets, the



Rapid Prototyping phase of the process involved an actual working model of a portion(s) of the storyboard. The team reviewed the prototypes biweekly, and these review and revise sessions resulted in the client / SME's having a better vision of where the website was headed and could make recommendations for smaller changes. We discussed the need for forthright feedback and were particularly concerned that our student developers would be offended by faculty critiques. However, this concern was unfounded and the students soon felt comfortable debating issues during these sessions. The subgroup of student programmers with the faculty advisor worked to produce the prototype for each subsequent review session. As the website developed, animation, sound, and interactive segments were integrated into it, bringing the product through a startling evolution in the period of a year.

## The Product

The final product was a website consisting of approximately 25 webpages that utilized the strengths of the WWW, such as hypertext links to resources and learner-directed menu choices. They consisted of a home page (see Figure 2), acknowledgements, instructions, and the case study. The case itself was divided into sections, organizing the story into its critical chronological stages. In the first section, students are introduced to the new teacher, the student, the principal and other teachers in the school. Demographics were available on the school itself, but the learner determined the order of information access and, in fact, whether or not to access the information at all. While making the information available, it was up to the learner to decide what information they needed and to discriminate between useful and nonuseful information.

*Figure 2. Getting Acquainted*



Links to resources such as student records and school guidelines were also embedded in the story and the learner had to decide to access the information. There were no menu links to these resources, as a practicing teacher would have to decide with in a real situation what information they might need to facilitate their decision-making. The client/SME specifically wanted students to have to actively investigate the resources, not just have them handed to them in the menu.

Student remote access was taken into consideration and any motion objects were animated gifs rather than video clips to eliminate download waits. Sound clip file sizes were kept small for the same reason and were only used where they supported the content or were used as an object of interest.

## Results of the Pilot

A field test of the product was conducted in the content specialist's spring semester of the course. At the end of the course, Likert Scale attitudinal surveys were completed by the 49 students. The feedback from these surveys impacted the final product, which was implemented the following academic year. The results (see Table 1) showed the students were very positive about the instructional value and aid to retention that the WWW based case study afforded them. They liked having control over the navigation

through the site and the accessibility of the instruction. Through the WWW they could spend as much time as needed in thinking through the scenario and their recommended solutions to the “Teacher’s Dilemma” case. In addition, the client/SME was delighted with the resulting product and was encouraged to think about other applications of technology within the existing curricula.

Table 1: Student Rankings of Key Variables

	Student Average Ranking
<b>Content of Study:</b>	
Memorable	4.24
Realistic	4.47
Thought Provoking	4.41
<b>Computer as a Medium</b>	
Pictures Added Meaning	4.59
User Friendly Instructions	4.12
Ease of Navigation	4.22
<b>Comparing Paper to Computer</b>	
Interesting	4.22
Enjoyable	4.37
Informative	4.63

The scalability of this project indicates the process can be successfully replicated in the remaining case studies of the course, if desired, as well as be applied to similar projects in other disciplines such as training and development. Providing controlled but accurate experiences, while still allowing for safe cognitive exploration, would encourage trainees to examine the various aspects of the situational simulation. The cost-effective nature of the web-based delivery makes this an attractive alternative to paper and ink.

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# WHAT SOFTWARE SPIDERS CAN TEACH US ABOUT COLLABORATION

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Crossing over academic disciplines in higher education is seldom done unless there is a compelling reason, such as the information technology department overlapping into the social science department in an online history course. Ironically, different departments can often be located in the same building, yet the walk across the hall from one college to another can be a very long one. Two departments working together on a project, particularly in departments like the College of Technology or the College of Education, can prove more difficult than the biblical expression “passing a camel through the eye of a needle.”

Occasionally, however, in social greetings, conversations can ensue that have a synergistic effect and grow into joint projects. Collaborative efforts develop between colleges that have not previously worked together. Such is the case in this study. Two instructors from different colleges in a university casually discussed a research project that could benefit both departments. They would create a project that would combine student and technology resources in both departments. Once the idea was conceived, the two instructors decided upon a topic, a research methodology (qualitative), then embarked upon the task of assigning the project to students in the fall semester of 1999. The basic concept was to develop a software "spider" that would search the World Wide Web to detect student plagiarism using keyword and textual searches. Such spiders and other software tools, like intelligent agents and knowbots, are commonly used to reduce the time of mundane repetitive Internet tasks. (A good example of such a task would be finding the lowest airfares online, or looking for sites with the lowest mortgage rates, etc).

Since the first instructor worked in the Instructional Technology (IT) Department in the College of Education, she was familiar with both curriculum design and software applications, but even though she taught technology applications and courseware design, none of her students had actually created any software. There had never been an opportunity to design or test a product in her classes, so she wondered how that process could be experienced with students. Moreover, her research had been concentrated on the effects of semiotics on courseware design (GannonCook, 1999; GannonCook 1998). She felt it would be interesting to actually design a software program with a metaphoric theme and see if this theme facilitated recognition for the functions and features of that course. She had been searching for a way to create both the software and a way to test the importance of metaphor in software design.

The second instructor worked in the Computer Science (CS) Department. He had written numerous textbooks on computer instruction and supervised graduate students' software designs for many years. One of the more interesting courses that he taught actually mentored students from the first stages of design all the way through to the dissemination of the product. This course was called a capstone course because it was the culmination of the students' learning and the alternative to a Masters' thesis. The capstone course usually included outside mentors that worked with students so the students would get a real world understanding of development teams. Students in his courses have worked with mentors from NASA, industry and business, and other universities to develop actual products instead of just going through classroom programming simulations. His software projects have covered a wide array of products and have also incorporated website design, database creation as well as various types of hypermedia into this capstone experience.

During one of their friendly “water cooler” discussions, the second instructor mentioned he had students who could work in internships and that there might be a student who would fit the needs of the IT instructor's dream project. After several additional discussions, they decided that, indeed, this project might be one that could be meaningful, not only for this study, but others. If research could be conducted on how the software was developed, how the software metaphors were selected, and how the software

application functioned as an Internet spider, it could provide meaningful data to both colleges within the University (Gallini, Seaman and Terry, 1995; Verene, 1993). So they went back to their worlds and worked on a research plan, then reconvened to collaborate and combine their plans (Bertalanffy, 1968; Bonk and Cunningham, 1998; Bonk and King, 1998).

A pleasant surprise to both instructors was that their plans and objectives turned out to be very similar (Ferris, Roberts, and Skolnikoff, 1997). They discovered that, despite different departments, their philosophies and design strategies were compatible (Dillon, 1996; Dillon and Gabbard, 1998). They converged their research objectives into one plan, which they set out to implement through the collaborative capstone project with one or several graduate students (Goss, 1996; Hirumi, 1999; Kauffman, 1978).

A timeline was created and a search for students ensued. Once the team of students was selected, a third person who had volunteered to mentor students in the software design was invited to join the team. Several students were selected to participate in the project. Now the team members would see how the ideas could be developed into a product. Hopefully, they would also observe how the student or students created the software program and how the student(s) learned to work with others in a collaborative team environment with other group members. It would be crucial that members work well together and communicate status of each phase because of the short amount of time allocated to create and complete the project (Havernik, Messerschmitt and Vandrlick, 1997).

Several students opted out of the project for various reasons, so it distilled to one student who was a very proficient programmer, but was not from the United States so English was not his primary language. He had no experience working in the United States either, so it would be a new experience to work with other nationalities in any kind of collaborative environment. This student was assigned to work with the IT teacher and was told to embark upon his course with “an open mind and a handy notebook”.

Once introduced to the IT instructor, they had a lengthy discussion about the instructional design of the project and how that design would dictate both the software design and implementation. The original idea had been to design a software program that would search out plagiarism on the World Wide Web. The collaboration between the student and the IT teacher would be an experiment too, since both were coming from different disciplines and backgrounds. Fortunately the student and IT teacher worked well together, and the experiment resulted in the student’s design of a spider software program that would search out plagiarism on the World Wide Web in a number of search modes.

The second instructor then reconvened with the first to discuss and review how the collaboration between the IT teacher and student had worked, and to assess the success of the software design. The overall success of the interdisciplinary collaboration would be gauged by the functionality of the software. But the ongoing success of the project and future collaborative projects would depend on the ability of the team members to work well together.

The student worked with the IT instructor, the programming mentor, and the CS instructor and developed a software program that would search out and find plagiarism on the Internet. He created Java servlets for the web server; search forms and software to act as spiders that would catch plagiarized online works, and built search engines that would search for classes of searches by author, phrase, and direct hits. Altavista was selected as the commercial search engine of choice to utilize the spider program for searches, and the spider software was designed to send e-mail to both the plagiarism transgressor and the creator of the plagiarism search. An administrative program was written that created and administered a database of information extracted from the web searches. Last a program was written (a phrase highlighter program, or PHP), that allowed any user to submit to submit documents using HTML forms and review uploaded HTML forms.

In this instance the team members worked well together, meeting periodically and sending each other e-mails to report the progress or challenges of the project. The results were the creation of the program that provided information on where plagiarism transgressions existed and advised searchers of these infringements. The project went well and the team members discovered that some of the most frustrating problems occurred, ironically, not because of design or collaborative efforts. Most of the problems revolved around server hardware and software problems. Since students only had one semester to create their projects, the student involved in the spider project could only create the basic program and had to leave improvements to be made in future capstone projects.

### Lessons Learned from Working with Spiders

The creation of the spider project provided a product, but even more important, it created a collaborative web for all of the participants. It interwove threads between the two departments that had not really worked together prior to the project; it involved the student in a real-world scenario with deadlines and diverse corporate partners; and it created an actual product that could prove useful in the Internet marketplace. The IT instructor had the opportunity to participate in the actual creation of a product. In addition she was able to assist in creating a product that used a metaphor, the spider web, which could also be assessed for relevance and user recognition (Lee, 1985). Future research could look at metaphoric content and research the effects of these factors on the ease of use of these kinds of products.

The CS instructor had the opportunity to observe how his capstone student worked in a collaborative group environment with both corporate mentors and another department within the university. He felt that this was a particularly beneficial experience for the student because the university mentor was an instructional technologist. She had provided the student with valuable insights on how to prepare his documentation for review by other team members and had given constructive feedback on the functional design of the product. The CS instructor felt that future collaborations could provide even more insight into team project development and hoped additional projects would emanate from this effort.

The third mentor, the entrepreneur, was excited about the project because, as a corporate e-commerce entrepreneur, he had acquired a potential employee to develop future commercial products with the help of interns that needed the real-world experience of working for a corporation. There would be opportunities to develop grants to provide to the university by corporate sponsors for the continued creation of projects like the one developed in this study. It was a good incentive for the mentor to consider additional collaborative efforts with the university on future projects.

The capstone project was beneficial to the student because it not only gave the student deadlines and scenarios similar to the ones he would encounter when he graduated, but it also gave him the experience of working collaboratively in a team. He created the product required for the satisfaction of the capstone course requirement and graduation, but walked away with a better understanding of what it was going to take to actually communicate his ideas and programs. The student provided his observations to his instructor in a journal. Here are some excerpts of his final thoughts on the spider project experience:

- Team spirit is very important for the success of the project.
- Whether the project succeeds or not is mostly decided by the client's satisfaction with the product.
- The skills necessary to create the product are crucial, but so are the presentation and communication skills necessary to convey what needs to be done to make the product possible (Zhong Xie, 1999).

He had emerged from the project with a respect for qualities he never before had considered to be important in writing programs and creating software, the qualities of good communication and reliability.

The outcome surpassed the two instructor's expectations. The project created by the collaboration had cast a web that reached far beyond the original idea formed at the water fountain between the two departments. It had become more like the old children's nursery rhyme of the "Itsy Bitsy" Spider. The rhyme describes the "Itsy bitsy spider crawls up the water spout, down comes the rain and knocks the spider out. Out comes the sun and dries the spout again, so the itsy bitsy spider goes up the spout again." (Anonymous nursery rhyme)

There had, indeed, been times when the project had been knocked down, then the team and student "climbed up the spout again" by trying another option or persisting until a solution was found. The result was the creation of a software program that could be resilient and survive downpours of everyday virtual functionality.

The spider proved to be a good metaphor, demonstrating resilience and casting its' web to catch intruders. This software spider taught a memorable lesson about respect for ownership, but more important, it taught lessons about persistence. Most of all, the biggest lesson may have been learned by the interaction and participation of team members on this project. Real spiders may weave solitary webs and catch prey, but this virtual spider wove a web that was strong because of its successful team collaboration.

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# DEVELOPMENT OF PROGRAM ON EDUCATIONAL TECHNOLOGY IN CHINA

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*In comparison with that in other countries, Program on Educational Technology in China has its own characteristics as well as similarities to other countries. This paper will in detail introduce evolution of this Program in China as well as its current status, including job orientation of graduates and an organization related to it. Problems existing in this Program will be qualitatively analyzed. At the end of this paper, some ideas about the Program both at Beijing Normal University in China and Indiana University in U.S.A. will be addressed.*

## **1. Social needs related to the profession of Educational Technology in China**

A program exists because there must be some social need for it. It is the same as Program on Educational Technology.

In China, there is a large system of educational technology organizations. It includes educational technology in K-12 education, named Educational Technology Unit, in collegiate education, by the name of Educational Technology Center, as well as in society, such as Educational Technology Center or Ministry in bank system, in medical or other systems. In the meantime, many Educational Technology Centers exist in central, provincial, city as well as county levels. Most of them are in charge of development of educational technology in K-12 Education. Also, there are programs in universities at bachelor, master and doctoral degree levels. Therefore, professional personnel on educational technology are urgently needed in order to make the enterprise of Educational Technology run productively. It is widely recognized that Program on Educational Technology, which the professional personnel come from, is vital to advancement of the whole field in China.

## **2. Process of development of Program on Educational Technology in China**

Simply speaking, there are two stages in the process of development of this Program.

### **(1) Spontaneous stage**

Educational Technology was born in 1920s in China. In 1930s, it was developed preliminarily. Program on Educational Technology in China originated from training in the 1930s. At that time, audio-visual media were applied into schools and universities. There was need for professional personnel who could operate the electronic media. Therefore, related seminars were organized by Ministry of Education as well as courses offered by some universities, for example, Da Xia University. In September 1936, Specialty of Film and Broadcast Education was established in School of Education in Jiang Su Province. In 1946, it was renamed Specialty of Electrified Education. Also, in 1938, Specialty of Film and Broadcast Education started in School of Science at Jin Ling University. These are the first try of establishing Program on Educational Technology in China.

But no further advancement happened in the later forty years because of the anti-Japanese war, civil war, cultural revolution and so on. At the end of the 1970s, Program on Educational Technology restarted at Hangzhou University, Zhejiang Normal University and Fujian Normal College in Department of Physics. At that time, it was called Program on Electrified Education because it focused only on the application and maintenance of electronic devices. Before the 1980s, the development of Program on Educational Technology was spontaneous, that means there was no central governmental layout for this Program.

### **(2) Unifying layout stage by Ministry of Education**

In 1979, approved by Ministry of Education, two separate Institutes of Modern Educational Technology were built in Beijing Normal University and Hua Dong Normal University. They did a very good job to start the exploration of Educational Technology in China.

In November of 1983, a national conference was held on educational technology, posing a whole arrangement for the establishment of Program on Educational Technology. From then, Program on Educational Technology was gradually established in central and provincial Teachers' Universities at the bachelor level. This is the first time for Educational Ministry to assign all the issues related to Program

building. In December 1986, the Committee of Degree in State Department approved that Beijing Normal University, Hua Nan Normal University and He Bei University could award Master degrees on this Program. Further, in 1994, Beijing Normal University got the permission of offering doctoral degrees from the Committee of Degree in State Department.

Up to now, there are more than 30 universities having this Program offering bachelor degrees, about 15 universities can offer master degrees. There are three universities, which can award doctor degrees. Also, the name of this Program has gradually changed to Program on Educational Technology instead of on Electrified Education. It signified the focus of this field shift from hardware to software as well as gradually to system approach.

An academic association was formed in China in 1991 in order to deal with Program issues---Instructional Material Consult Council of Program on Educational Technology. At that year, it held a meeting. During that meeting, a unified curriculum and syllabus for undergraduate, which was developed by Beijing Normal University, passed the examination. Since then, we have had a unified standard for undergraduates in this Program.

This Council also organized and compiled many textbooks for undergraduates. Upon completion of these tasks, the name of it was changed from Instructional Material Consult Council of Program on Educational Technology to Instructional Consult Council of Program on Educational Technology, and it is responsible for research issues related to this Program. It has been helping to pave the way for the smooth development of this Program.

About the undergraduate level, in 1997, we conducted a survey about the Program on Educational Technology in Universities. There were 29 questionnaires sent out, and 17 questionnaires came back. Here are some results about this survey:

•Job orientation after graduation from Bachelor degrees

From the highest percentage to the lowest, the graduates with bachelor degrees took the jobs in :

**A:** K-12 education      **B:** collegiate education

**C:** Educational Technology Centers in different levels,

**D:** Academies      **E:** others      **F:** TV Stations

**G:** Educational TV Stations      **H:** Government departments

**I:** Corporate training      **J:** Radio and TV Universities in different levels

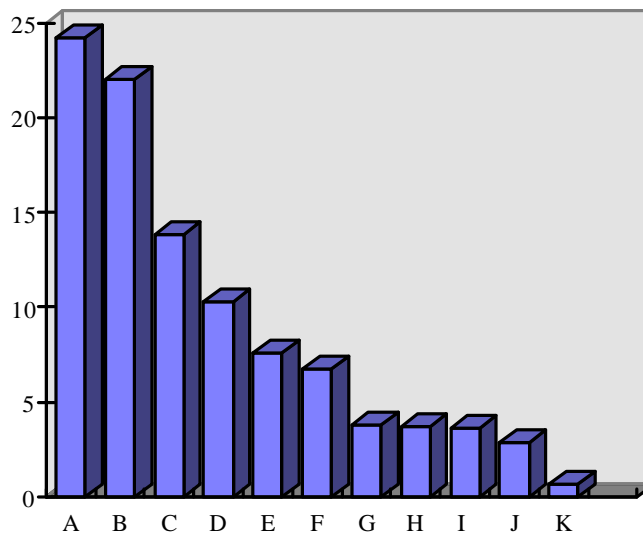
**K:** Audio-Visual publishing press

Among those, “others” means the jobs are not closely related to the Program on Educational Technology, like business etc..

*Figure 1. Job orientation after graduation from bachelor degrees<sup>6</sup>*

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<sup>6</sup> The data came from a survey analyzed in 1997.



• Types of work the graduates engaged in

The graduates would engage in these kinds of jobs according to the relative percentages:

**A:** Instruction

**B:** TV program producing

**C:** TV technique

**D:** Producing Audio-Visual instructional materials

**E:** Others

**F:** Audio-Visual management

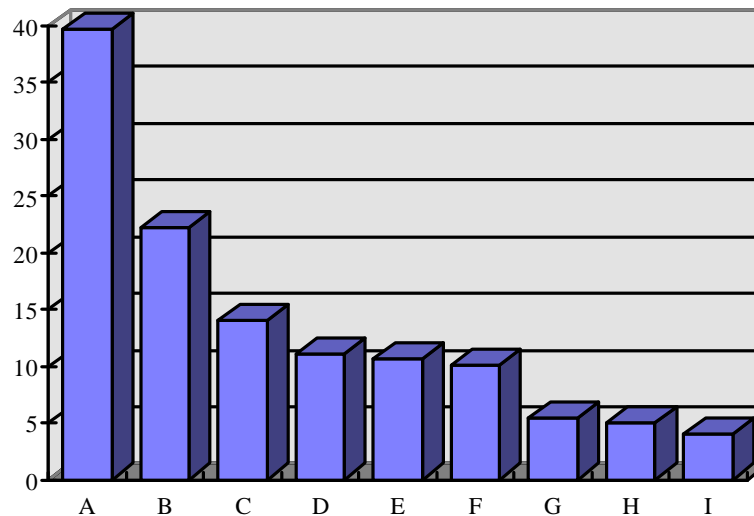
**G:** Software development

**H:** Research on Educational Technology

**I:** Gathering and editing news.

The same thing as the former figure, “others” means their work is not related to the Program on Educational Technology.

*Figure 2. Types of work the graduates engaged in<sup>7</sup>*



<sup>7</sup> The same as footnote 1.

From these two figures, it is known that most graduates from bachelor degrees engaged themselves in the work related to educational settings. Also most of the jobs are related to the Program on Educational Technology. But there is still a certain amount of percentage of “others” not related to this Program.

### **3. Existing problems in the Program and Corresponding strategies**

(1) There is a problem with the system as well as position of the Program.

Most universities put this Program into the Department of Physics at the very beginning. And they gradually became independent departments, but still not closely associated with Educational Departments. Also, among other Programs in the field of education, few have recognized this Program’s importance.

(2) There is a problem with professional quality of faculty in this Program

Since we have had graduates with master degrees from this Program in 1990, with doctoral degrees in 1997, most faculty members in this Program come from other majors, for example, physics major. Also, most of them have not doctoral degrees, even master degrees. The quality of faculty is still a problem existing in this Program development.

There is a high need for graduates with master or doctor rather than bachelor degrees. We should have more master and doctor students registering in the Program on Educational Technology rather than bachelor students.

(3) There is a problem with the strategy of curriculum

Technology and applying technology into instruction is an important part of Educational Technology. Also, it is an ever-changing part as we forge into the information society. That leads to even more unstable content in Program on Educational Technology than that on Physics and some other majors. From a curriculum angle, we should create a balance between ever-changing social needs and stability of the curriculum system. We need to design a new curriculum strategy.

Colloquium or other workshops should formally be introduced into the curriculum system in order to make sure that students can have the latest information in this field.

(4) There is a problem with students’ real-life experience either in educational settings or in corporate settings

Students in this program lack real-world experience both in teaching and in corporate training settings. Most undergraduates come to universities directly from graduation from high school. So it is difficult for them to understand some of the courses closely related to teaching experience.

A bridge should be built between the Program and the practical educational technology field in Educational as well as corporate settings in order to offer more opportunities for students to intern.

### **4. Case study: Comparison between this Program at Beijing Normal University and that at Indiana University**

Beijing Normal University is very famous for education all over the country. Program on Educational Technology at Beijing Normal University is also a representative for this Program in China. Here are some ideas about the comparison of this Program between Beijing Normal University and Indiana University.

(1) About the system

From 1985, Program on Educational Technology had been one of three Programs in the Department of Radio and Electronics. Since 1999, it became an independent department, and together with three other departments, Computer Department, Radio and Electronics Department and Library Science Department, there established a college named Information Science College.

Whereas, Instructional Systems Technology Department belongs to School of Education.

(2) About the degrees offered

Beijing Normal University can offer bachelor degrees, master degrees and doctoral degrees on this Program. It takes students four years to get bachelor degrees, three years for master degrees, and three years for doctoral degrees. But if a doctoral student is only a part-time student, He or she can spend at most five years to finish his or her study. Not only do master students have to finish certain credits’ courses, but also they should have to write a dissertation with the same process as doctoral students’, but maybe not as involved as doctoral students’.

IST at Indiana University can award master and doctoral degrees. Master degree is for one to two years, and doctoral degree for three to seven years. There is no need for master students to write a dissertation, but they have to compile a portfolio.

(3) About the instruction

Most of instruction is project-oriented in IST at Indiana University. They put more emphasis on producing knowledge by students themselves. Also, through project approach, team building and cooperative ability are developed.

As to instruction of this Program at Beijing Normal University, as well as some other universities around China, we usually emphasize imparting knowledge to students. We encourage dialogues between students as well as between teachers and students, but not exactly the same way as here.

(4) About the focus of Program

Educational Technology Department at BNU mostly prepares students for educational settings. However, IST Department at Indiana University focuses on both educational settings and corporate settings.

In China, we have fewer educational software companies. Also, the training issues in companies are not very formally conducted except for foreign or joint-ventured corporations. So, there are potentials for China to develop this Program in Corporate settings in the future.

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About IST history in Indiana University, see Website:

<http://education.indiana.edu/isthome.html/students/history/history.html>

# CURRENT STATUS OF LEARNER SUPPORT IN DISTANCE EDUCATION: EMERGING ISSUES AND FUTURE RESEARCH AGENDA

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## Abstract

*The importance of learner support has been emphasized over and over in the distance education literature but there is a lack of comprehensive analysis of this issue. Besides that, most of existing studies on learner support are based on large-scale correspondence program and few of them provide guidelines for planning and implementing support services in web-based environments for dual-mode institutions, which is the majority of distance education program providers in nowadays. In this paper, a body of literature on learner support, including various journal articles and technical reports, was examined, and three issues emerged from the review: (1) the lack of research on cost-effectiveness of learner support, (2) the lack of empirical research, and (3) the need for learner-centered approach in designing and implementing learner support. These issues are discussed in detail to enhance our understanding of learner support in post-secondary level distance education program, and it is further argued that future research should focus more on developing and refining methods for cost-benefit analysis of learner support, developing a general framework of learner support model in dual-mode institutions, and developing systematic methods to identify, analyze, synthesize, and assess the needs of distance learners.*

## Introduction

The needs for learner support in distance education comes from the recognition that learning in distance is often mediated by networked computers with individualistic interfaces that require learners to work alone for the majority of learning process. Since neither the instructor nor their peers are physically present to help and direct access to learning resources and facilities are somewhat limited, distance learners have unique needs, and many researchers and practitioners believe that providing distance learners appropriate support services would increase the quality of learning (Feasley, 1983; Gunawardena, 1988; Sahoo, 1993; Watkins & Wright, 1991). It is not surprising that learner support is used as an important accrediting criterion used by most accrediting agencies (The Institute for Higher Education Policy, 2000; Broad, 1999; Mantyla & Gividen, 2000).

As more and more post-secondary institutions are offering distance education programs or planning to do so in the near future<sup>8</sup>, there is a great need for research on designing and implementing learner support services. However, the majority of existing studies on learner support are based on large-scale correspondence programs (i.e. Open University in U.K.), and few of them provide a comprehensive analysis of support services in web-based environments or guidelines for establishing and managing learner support systems in dual-mode institutions (Koble & Bunker, 1997; Simonson, Schlosser, & Hanson, 1999).

There can be several forces underlying the gap between research and practice of learner support, but Robinson (1995) attribute the following two reasons to explain the situation: (1) learner support has been perceived as peripheral to the 'real business' of distance education which is developing course materials, and (2) many researchers tend not to consider learner support as a suitable topic for research since it is contingent on local circumstances and thus not easy to generalize the findings.

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<sup>8</sup> According to a 1999 survey by the National Center for Educational Statistics (NCES), nearly 1/3 of all 2-year and 4-year postsecondary institutions offered distance courses in 1997-98, and additional twenty percent of them were planning to offer distance courses within three years.

His points may have been relevant in the past when distance education was viewed as inferior alternative to traditional face-to-face education and the emphasis was on the product, rather than the process. But things are changing, if not already changed, and distance education is considered as a major phenomenon in higher education these days. Distance learners are much more sophisticated, diversified, and demanding than ever, and they expect a lot more than well-designed learning material. Besides that, the competition among distance education providers is such that if an institution fails to satisfy the students, it will lose them to one of its competitors. Thus many institutions offering distance education programs are struggling to better meet the needs of their students. Unfortunately, research on learner support at this point is not able to provide much guidance for the institutions to cope with these problems, and practitioners are learning the lessons in a hard way – by trials and errors.

After reviewing the literature, three issues emerged as most problematic areas in research on learner support: (1) the cost-effectiveness of learner support, (2) the lack of empirical research and the difficulties in generalizing research findings as a result, and (3) the need for learner-centered approach. I believe tackling these issues with greater depth will help enhancing our understanding of learner support in distance education and also help advancing research in this area. Thus the purpose of this paper is to review current status of research on these three issues and suggest recommendations for future research on learner support in distance education.

## **Definition of Learner Support**

Defining the key elements and boundaries of learner support is important in research since it provides a criterion in determining the standard or quality of learner support. However, learner support is rather a broad concept and its definition varies (Robinson, 1995; Sewart, 1993). Some researchers consider resources and interactivity as critical in defining learner support (Garrison, 1987) while others put more emphasis on individualization or customization of services (Thorpe, 1988; Tait, 1995).

There are two distinctive views to approach learner support – supplementary and complementary/holistic (Robinson, 1995; Tait, 1995; Rowntree, 1992; Nunan, 1993). The former is more limited in that learner support is confined as an add-on to course materials or other learning experiences while the latter view it as a crucial factor which pervades the entire education program and something without which distance students' learning experience cannot be complete.

It seems that more and more researchers are taking a holistic approach considering learner support as an integrated part of course and the entire learning process (Sache & Mark, 2000; Scalzo, Matela-Rodier, & Ferraiuolo, 2000). From complementary perspective, learner support is all about providing access to both resources and opportunities that leads to lifelong learning (Reid, 1995; Smith, 2000). It extends the range and duration of services and emphasizes the importance of providing quality information, advice and guidance at pre-enrollment and early post-enrollment stages. Hardy & Boaz (1997) even extend the concept of learner support into the next level – “learner development” meaning preparation of the learners for a distance learning experience beyond the technical assistance.

## **What are the Elements of Learner Support?**

There is an almost infinite variation in learner support systems in distance education, and as Sewart (1993) commented, each system is unique in a sense that it is dealing with a different student population in a different context. Thus developing a general yet representative framework of learner support has been a challenging task for researchers in this area.

One of the most comprehensive lists of elements of such a system was developed by Keast (Keast, 1997). He identified four distinctive types of support for distance learners - administrative support, instructional support, technical support, and counseling/tutorial support. This list is by no means exhaustive and misses library support, a very important category that is gaining growing attentions these days. However, it still captures key functions of learner support and most support services suggested by other researchers or practitioners fall under Keast's categories (Aoki & Pogroszewski, 1998; Frieden, 1999; Reid, 1995; Sache & Mark, 2000; Tait, 1995).



Each category will be further elaborated in the following section, and considering the special relevance to current emphasis on informational technology in distance education, library support will be added to Keast's four elements of learner support system.

### **Academic/Tutorial Support**

Academic/tutorial support is largely based on Open University model in U.K. where students have access to local study centers and tutors who supervise their academic progress and help with problems (Watkins & Wright, 1991; Sahoo, 1993; Rae, 1989). In more recent web-based distance education programs, the focus of academic support gears toward facilitating collaborative learning and increasing interactivity between distance students and instructor or among distance students (Aoki et al., 1998). Some of the examples of such services include syndicate or learning groups, support by instructor on request, workshops to assist students to develop specific skills or bridge skill gaps, supervision support on research project, and "learning contract" and scheduling (SAIDE, 1998).

### **Administrative Support**

Administrative support services involve maintaining basic program functions such as admissions, registration, course scheduling, student records, and financial transactions (Frieden, 1999). These services are often taken granted but when not planned carefully, they cause greatest frustration from distance students.

### **Technical Support**

Technical support refers to monitoring efficient operation of delivery mediums and offering technical assistance. While much research has been conducted on the use of new technologies in designing and developing distance courses, less effort has been directed toward the use of new technologies to provide support services for such courses (Abate, 1999). Providing an 800 telephone number for students to contact the faculty and staff, requiring that all students have access to email and know how to use it, requiring faculty to schedule office hours particularly for distance students at times that would be convenient to the students (Reinert & Fryback, 1997), and it may be necessary to devote additional on-campus facilities to support the off-campus population.

### **Counseling Support**

Counseling support includes various aspects of guidance and advising. In correspondence studies or other delivery medium with more individualistic interface, the focus of such services tends to be focused on how to deal with academic concerns and/or career advising. In many web-based distance education programs, counseling support also deals with ways to improve communication skills and increase interactivity, and even network with alumni and community building (Aoki et al., 1998).

Many institutions are also requiring orientation sessions that bring the students on campus in order to familiarize them with the services that are available. Such sessions would provide an opportunity to learn the interfaces used to access the services as well as a chance to interact with the support personnel on-campus (Thompson, Winterfield, & Flanders, 1998).

### **Library Support**

Access to adequate library services and resources is essential for the attainment of superior academic skills in post-secondary education and distance learners are entitled to library services and resources equivalent to those provided for students in traditional campus settings. However, traditional on-campus library services often fail to stretch themselves to meet the library needs of distance students.

The Association of College and Research Libraries (Libraries, 1998) provides a guideline for distance education programs to ensure that library support meet the students' needs in fulfilling course assignments (e.g. required and supplemental readings) and accommodate other information needs as appropriate. Some of the specific examples of library services to meet those needs include region-wide

borrowers cards, consortia membership between academic libraries, and fax and online capabilities for the timely document delivery (Aoki & Pogroszewski, 1998).

In a review of the literature on distance learning library support, Stephens (Stephens, 1996) stressed that what was lacking was not only books and journals per se, but instruction and the opportunity to do independent library research. To be able to fill this gap, distance library services need to be more customized and empowering distance learners, such as providing toll-free telephone numbers for library help desk and capabilities to use multiple databases and online public access catalog (Aoki & Pogroszewski, 1998). The combination of special funding arrangements, proactive planning, and promotion is necessary to provide such services (Smith, 2000).

### **Emerging Issues in Learner Support**

Many researchers expected that advances in technology would make it easier to provide quality support services with increased interactivity and automatization (Bates, 1994). However, for all those dramatic changes in terms of delivery medium, from correspondence to audio and video conferencing systems, then to the Internet in nowadays, many issues are remained as same, if not technology adds another level of complexity. Some of them are more critical and have greater implications for future research than others, and thus they will be discussed in more detail in the rest of this paper. Those issues are: (1) the cost-effectiveness of learner support services, (2) the lack of empirical research and difficulties in generalizing the research findings as a result, and (3) the importance of learner-centered approach in learner support.

### **Cost-Effectiveness of Learner Support**

The first issue is related to how to scale customized support services in a cost-effective way. In order to better meet the diverse needs of distance students, support services needs to be more individualized (Brent, 1995; Sahoo, 1993). Providing such services is not an inexpensive proposition, however, and the underlying assumption is that the greater the input to the provision of learner support services, the greater the completion rate and/or learning outcomes (European Commission, 1996).

At this point, there are few studies that offer guidelines on this area, and most of them are focused on cost analysis of technology infrastructure (Brent, 1999; Rumble, 1993, 1999; Whalen & Wright, 1999). Although those cost estimation studies do offer policymakers some insight into the types and range of costs associated with distance education program in general, we can only infer from this broader framework how much it will cost to provide certain support services.

One of the biggest challenges in approaching the cost-effectiveness of learner support is that the relationship between the input and output is not straight-line equation, and as the level of support gets beyond a certain point, the curve of student success seems to be flatten out (Sewart, 1993). The fact that there are relatively few references to direct and indirect costs involved with various support services also make it even more difficult to measure the cost-effectiveness of certain support services (Tait, 1995; Wagner, 1999).

The issue of cost-effectiveness in providing learner support services is also related to the mission of institution. The range and standard of learner support service provided by an institution will be eventually determined by whether it is more concerned about services or making profits from offering distance education programs. The bottom line is, in any case, the basic services needs to be provided regardless of the costs to guarantee the quality of education, and for beyond that, it is totally up to each institution to decide whether or not to offer more services.

Cost-effectiveness of learner support is likely to be achieved when the support system is structured to do "more with less," and this requires some creativity for institutions. One such example of scaling student services is partnering with other organizations such as businesses and school districts (Hickman, 1999). This may be an appropriate method for providing quality services by providing broader access and cutting the expenses on support staff training and maintenance by delegating the services to the specialists.

### **Lack of Empirical Research and Difficulties in Generalizing the Findings**

The second issue revolves around the dominance of pragmatism in research of learner support. There are almost infinite variations of learner support in distance education practice, and the choice and use of certain services among those numerous services is largely based on practicalities rather than research findings. This leads to a tendency that pragmatism outweighs empirical inquiry or research in the area of learner support, which is confirmed by Robinson (1995). Based on the review of previous research and practice in this area, he concludes that learner support is heavily contingent on local circumstances. There is nothing wrong with research informed by practice, and the contingent nature of learner support seems to be prone to such 'how to do it' type of case studies. However, there are missed opportunities where we can further exploit this critical issue in distance education.

Christenson (1998) made an interesting argument on how empirical research in social sciences may be used to guide practice as a framework. In developing theory in the social science, researchers' desire to extend the application of the best observed practice often leads them to emphasize too much on observation with the expense of theoretical reasoning. I believe this may be one of the major problems associated with pragmatic research in distance education, since in a case study, the generalizability of findings and its predictive power is somewhat limited to the institutional boundary where the practice is emulated. Thus this type of research often advocates the status quo rather than advancing theories and seeking/predicting changes beyond what has been observed.

Each support system is unique in a sense that it is dealing with a different student population in a different context, of course, but even so, we can always use of a general framework or model for learner support that is grounded in learning theories and supported by empirical data. Without such a framework, every institution needs to learn what does and does not work for them at expensive cost – trials and errors. And it would not just the institution but also the distance students that have to pay the cost.

### **Need for Learner-Centered Approach**

Last issue is related to the need for learner-centered or customer-focused approach in planning and implementing learner support. No one can understand the difficulties that distance learners encounter better than the learners themselves. Yet in many institutions offering distance education programs, learner support is based on top-down provision rather than analysis of learners' needs (Tait, 1995; Sache & Mark, 2000; Scalzo et al., 2000). It is not new to the field of learner support at all, and had already been clearly stated by D. Sewart (1987):

It does not seem unfair to suggest that there is an overwhelming tendency within the field to offer systems from the viewpoint of the institution teaching at a distance rather than from the viewpoint of the student learning at a distance (p.72).

Traditionally, education has represented a provider-led rather than a customer-led activity and the central question of identifying student needs were often neglected. In the past when distance education was viewed as a product, rather than a process, and the quality of learning was identified as the quality of learning material, institutions were able to operate successfully with the provider-led mindset.

However, things have been changed, and today's distance learners are much more sophisticated, diversified, and demanding than ever, and they expect a lot more than well-designed learning materials. Besides that, the competition among distance education providers is such that if an institution fails to satisfy the students, it will lose them to one of its competitors. Understanding learners are critical in providing appropriate support services for the survival of distance education institutions nowadays.

When incorporating a learner-centered approach in designing and implementing learner support, we have to understand that it is a continuous process, rather than one-shot activity. Different learners may have different needs, and those needs may be changed over time. Those differences or changes can only be traced by systematic and continuous efforts to identify, analyze, synthesize, and assess distance learners' needs.

Nunan (1993) suggests a user-pay system as a way to meet diverse user needs and expectation. He believes that by generating choices and options that can be purchased according to the individual needs and interprets, an institution can achieve customization in a more cost-effective way. This can be an insightful resolution approaching learner-centered support services, but if it is not followed by accurate descriptions of each option and counseling services, the learner may not be able to make informed decisions to select what is best for themselves. Also, the institution should provide some of the most basic

services such as library support or technical support as default. Otherwise, it may sacrifice the quality of education at the expense of convenience or cost-effectiveness.

## Suggestions for Future Research

Learner support in distance education needs to be justified not only pedagogically but also financially, and to be able to do so, research on learner support should support the following areas: (1) developing/refining the methods of cost-benefit analysis, (2) developing a general model of learner support in web-based, dual-mode institutions, and (3) providing a ways to systematically incorporate the needs of distance learners in designing and implementing learner support services.

There have been a lot of claims that providing appropriate learner support services would increase the quality of learning and would positively influence student retention and satisfaction. However, these claims were rarely accompanied by supporting data, which leads to the tendency that learner support services become vulnerable to financial fluctuation. The only way to deal with this issue is to come up with sound methodologies to measure the cost-benefit of learner support.

The framework suggested by Cuckier (1997) is promising in that it includes a 'value-directed' benefit dimension and thus more suitable for measuring the values added by intangible services as most learner support services. He proposed three types of benefit measures - performance-oriented, value-oriented, and value-added benefits, and it is believed that future research on learner support can benefit from applying his multi-dimensional framework.

Secondly, the learner support models based on correspondence programs and their underlying assumptions need to be tested under new web-based distance education programs in the future research. Large-scale, text-based distance education institutions such as Open University in the UK have well-grounded learner support systems such as tutoring, counseling, and advising, and have served as a model for learner support system in previous research (Tait, 1995; Singh, 1988; Sewart, 1993). However, dual mode institutions that are now developing web-based distance education programs are facing different challenges in establishing and standardizing administrative procedures and support systems to accommodate new technologies and diversified learner population.

Thirdly, future research needs to adopt learner-centered approach in designing and implementing learner support services and develop ways to identify, analyze, synthesize, and assess student needs and systematically adapt the support system to those needs. Thus future research should be able to utilize various methods to efficiently communicate with distance learners. Research on student attrition is believed to provide valuable insights to understand what are some of underlying hindrances or barriers in distance learning and thus help future research on learner support to better meet the learners' needs.

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# **EXPANDING THE HUMAN PERFORMANCE TECHNOLOGIST'S REPERTOIRE: KNOWLEDGE MANAGEMENT, ORGANIZATIONAL LEARNING AND HUMAN PERFORMANCE TECHNOLOGY LITERATURE REVIEW**

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*Successful performance improvement efforts draw from such disciplines as psychology and systems theory, and from the fields of instructional design and human resource development. Both knowledge management and organizational learning are valuable additions to the human performance technologist's repertoire for performance analysis and intervention selection. In this paper, I will discuss how the human performance technologist can augment human performance analysis and solution planning by drawing from knowledge management and organizational learning literature.*

The concept of organizations as learning systems emerged at the beginning of the twentieth century. However; it was not until the 1990s that we witnessed an overwhelming interest in the impact of knowledge management and organizational learning on organizational performance.

Current research on knowledge management and organizational learning has dealt primarily with theory and model building. In addition to the empirical research, there is an abundance of literature based on the experiences of practitioners and facilitators working in these fields (Davenport & Prushak, 1998; Preskill & Torres, 1999; Hansen, Nohria, & Tierney, 1999). The existing literature represents the first step in a long-term research program. The second research phase began in the late 1990s. It involves the development and validation of survey instruments to diagnose and establish learning organizations; and empirical studies that test models and describe the processes and outcomes of knowledge management and organizational learning on organizational performance (O'Dell, Grayson, Jr., & Essaides, 1998; Yeung, Ulrich, Nason, & Von Glinow, 1999).

Knowledge management is a conscious strategy of getting the right knowledge to the right people in the right time, and helping people share and put information into action in ways that strive to improve organizational performance (O'Dell, Grayson, Jr., & Essaides, 1998).

The focus of most knowledge management literature is on knowledge generation, codification and transfer. Knowledge generation encompasses knowledge acquired by an organization as well as knowledge developed within it. The aim of codification is to put organizational knowledge into a form that is organized, explicit, portable, easy to understand and accessible to those who need it. An essential element of knowledge management, which is vital to the organization's success, is to develop specific strategies to encourage spontaneous, unstructured knowledge transfer (Davenport & Prusak, 1998). Nonaka and Takeuchi (1995) defined organizational knowledge creation as the capability of a company as a whole to create new knowledge, disseminate it throughout the organization, and embody it in products, services and systems. Similarly, DiBella and Nevis (1998) stated that organizational learning is a cycle of three processes: knowledge creation or acquisition, knowledge dissemination, and knowledge use.

In contrast, O'Dell, Grayson, Jr., and Essaides (1998) proposed a seven-step knowledge process (create, identify, collect, organize, share, adapt and use). Yeung, Ulrich, Nason, and Von Glinow (1999) offered a different perspective about the organization's capacity to learn. They proposed that an organization's fundamental learning capability represents its capacity to generate and generalize ideas with impact (change) across multiple organizational boundaries (learning) through specific management initiatives and practices (capability).



Attention has also been given to the sharing of tacit knowledge and explicit knowledge at the individual, group and organizational levels. Both tacit and explicit knowledge are the key dynamics of knowledge creation in the business organization (Nonaka & Takeuchi, 1995). Davenport and Prusak (1998) explained that knowledge that is explicit can be embedded in procedures or presented in documents and databases and transferred with reasonable accuracy, whereas tacit knowledge transfer generally requires extensive personal contact between individuals and groups within the organization. The process of knowledge sharing is necessary if the organizational interpretation system is to transcend the various interpretations of problems and solutions at the individual level (Walsh & Ungson, 1997).

Literature on current business practices indicates that consulting businesses employ two different knowledge management strategies - codification and personalization. The codification strategy calls for knowledge to be carefully codified and stored in databases where it can be accessed and used easily by anyone in the company. With the personalization strategy, knowledge is closely tied to the person who developed it and is shared mainly through direct person-to-person contacts. Companies that use knowledge effectively pursue one strategy predominately (80%) and use the second strategy (20%) to support the first (Hansen, Noirha, & Tierney, 1999).

Organizational learning is defined as an adaptive change process that is influenced by past practice, focused on developing or modifying routines, and supported by organizational memory (Nonaka & Takeuchi, 1995). The essence of organizational learning is members' sharing of experiences and learning together (Schwen, Kalman, Hara, & Kisling, 1998).

The organizational learning literature is primarily devoted to the development of new or different organizational structures that support the conditions for learning. Managing intellectual capital requires organizations to create and sustain an environment where employees want to contribute their ideas, innovations, and analysis, and which receives them willingly (Horibe, 1999). Tampoe (1996) states that a facilitative environment interacts with the individuals motivational drive and competence to release motivational energy. This motivated energy is directed into professional and personal achievement by ensuring that individuals have a clear sense of purpose and are sustained by access to information and peer contacts.

Conversely, Weick and Westley (1996) argue that organizing and learning are antithetical processes, which means the phrase *organizational learning* qualifies as an oxymoron. They state that to learn is to disorganize and increase variety, whereas to organize is to forget and reduce variety. Consequently, organization must be reduced in order to create conditions conducive to learning. When organizations are allowed to exist as self-organizing entities, then learning and knowledge come to the surface naturally, because survival depends on it (Cavaleri & Fearon, 1996). Lyles and Schwenk (1997) hold a similar view regarding structures that support organizational learning. In tightly linked or coupled knowledge structures, there is strong consensus among organizational members. There is greater rigidity in the sense they do not have flexibility in responding to environmental changes. However, loosely coupled structures incorporate more disagreement and alternative interpretations. Changes can be made easily since there is more flexibility in action taking and strategies.

Organizations build learning capability through a variety of processes. O'Dell, Grayson, Jr., and Essaides, (1998) promote the use of benchmarking between organizations and within the organization. Benchmarking is a process of systematically finding and adapting best practices in order to improve performance. A broader view of how organizations approach the learning process is supported by the research conducted by Yeung, Ulrich, Nason, and Von Glinow (1999). They argue that there are four different styles of organizational learning: experimentation, competency acquisition, continuous improvement and benchmarking. Competency acquisition and continuous improvement are the most popular learning styles based on survey findings, yet experimentation has the most positive effect on business performance.

In terms of best practices, many successful organizations have abandoned hierarchical structures, organizing themselves in patterns specifically tailored to the particular way their professional intellect creates value (Quinn, Anderson, & Finkelstein, 1996). In inverted organizations, the former line hierarchy

becomes a support structure. Some organizations have created intellectual (spider's) webs in which people are brought together quickly to solve a problem and then disbanded just as quickly when the job is done.

An applied field whose aim is the achievement of valued human performance in the workplace is human performance technology. Human performance technologists adopt a systems view of a performance gap. They systematically analyze both gap and system, and design cost-effective and efficient interventions that are based on analysis of data, scientific knowledge and documented precedents in order to close the gap in the most desirable manner (Stolovitch & Keeps, 1992). Foshay and Moller (1992) describe human performance technology as an applied field of practice that is structured primarily by real-world problems of human performance (in the workplace). It draws from any discipline that has prescriptive power in solving any human performance problem. It also may draw from other applied fields when they contribute technologies of use in solving human performance problems.

Performance analysis is a process for defining the business need and isolating root causes of problems within existing systems or for identifying opportunities and constraints in the introduction of new structures, systems or machines (Brandenberg & Binder, 1992). Primary interventions used by human performance technologists include: training, job aids, feedback systems, employee selection, and organizational technology (Foshay & Moller, 1992). Schwen, Kalman, Hara, & Kisling (1998) add that the human performance technology analysis process involves collecting data and information that can lead to the discovery of new knowledge and make tacit knowledge salient, and the solutions may involve interventions related to two or more root causes, and integrated interventions such as relevant information data bases, coaching and mentoring, and modification of related rewards and incentives.

Some common themes have emerged in the literature with respect to knowledge management, organizational learning and human performance technology. Knowledge management involves three main processes: generation, codification and transfer of knowledge. While explicit and tacit knowledge are necessary for organizational learning to occur; it is recognized that because tacit knowledge is hard to articulate in formal language it is also more difficult to disseminate and transfer. The organizational learning literature indicates organizations that have developed structures and strategies that nurture and support learning have experienced improved performance despite the rapid changes facing organizations. Human performance technology relies on thorough performance analysis to identify all factors contributing to the current level of performance and to propose alternative interventions that will eliminate the cause of the performance discrepancy.

Another trend that is emerging in the literature involves the contribution of knowledge management to the field of human performance technology. Rossett (1999) outlines that knowledge management perspectives can influence analysis. Analysts would provide learners with a knowledge management resource that provides meaningfully organized data elements. To develop this resource, the analysts must capture an array of diverse experiences and examples, and include rich commentary that assures a deeper experience for users when they choose to review both the knowledge element and people's ideas about it. Schwen, Kalman, Hara, & Kisling (1998) state that the knowledge management literature gives linking concepts to human performance analysis (i.e. making tacit knowledge explicit, identifying hidden needs) and solution planning (i.e. capturing expert's knowledge, mental models).

The knowledge management literature states that tacit knowledge is hard to articulate in formal language and it is also more difficult to disseminate and transfer. During the performance analysis process, the human performance technologist must find ways to make this tacit knowledge explicit. In addition to the standard data-gathering tools (observation, interviews, surveys, and extant data analysis), the human performance technologist could employ critical incident analysis to draw out the tacit knowledge. Critical incident analysis is used to elicit *war stories* by asking individuals to describe, in terms of behaviour, what exactly they had done (correctly/incorrectly). During the intervention planning phase, the human performance technologist must take into consideration that explicit knowledge can be embedded in procedures or presented in documents and databases and transferred with reasonable accuracy, whereas tacit knowledge transfer generally requires extensive personal contact between individuals and groups within the organization. Interventions such as classroom training, policy and procedures manuals, data base systems, and job aids are generally limited to the transfer of explicit knowledge. On-the-job training, under

the guidance of a coach or mentor, should be considered for transferring tacit knowledge that is closely tied to the person who developed it ,or which is shared mainly through direct person-to-person contacts.

Both knowledge management and human performance technology literature focus on competencies (knowledge and skills) required for individuals to perform their work and to enable the organization to maintain its competitive advantage. It is becoming increasingly important for organizations to attract and retain competent individuals with exceptional talent. Human performance technologists should examine what organizations have in place, or should have in place, to further develop each individual's knowledge and competencies, and to support each individual's ability to contribute to the organization's objectives.

Individuals search for knowledge because they expect it to help them succeed in their work. Individuals learn within the organization when they acquire knowledge through education, experience or experimentation. Attention should also be given by human performance technologists to identify which learning style (experimentation, competency acquisition, continuous improvement, or benchmarking) organizations employ. Since organizations learn from both direct experience and the experience of others, the human performance technologist will need to look at intervention designs that enable the system and culture of the organization to retain and transfer knowledge from individuals. In this way, organizational learning will be embedded in the organization's routines, technologies, policies and procedures, and in patterns of behaviour that continue to exist despite turnover of individuals.

The literature on organizational learning indicates that managing intellectual capital requires organizations to create and sustain an environment where employees want to contribute their ideas, innovations, and analysis, and which receives them willingly. During the performance analysis phase, the human performance technologist should study the organizational structure and job requirements to determine the extent to which the organization allows for the existence of naturally occurring learning events. In order to plan appropriate solutions, the human performance technologist should investigate how the organization enables individuals to access knowledge that has been codified and stored in documents and databases, and how it fosters personal contact. Personal contact can be achieved through on-the-job training under the guidance of a coach or mentor. Alternatively, organizations could form action learning teams or employ intellectual (spider's) webs in which people are brought together quickly to solve a problem and then disbanded just as quickly when the job is done.

Future endeavors in research should provide empirical evidence of the value of knowledge management and organizational learning to organizational performance. As stated earlier in this report, the study of knowledge management and organizational learning is currently moving towards broad-based, empirical research. The knowledge gained from this research will enable human performance technology researchers and practitioners to implement interventions based on tested models, and proven processes and outcomes of knowledge management and organizational learning.

There is also a need for human performance technology researchers to apply paradigms for research that will be both effective for theory development and appropriate to the settings of human performance technology practice. Human performance technology by its nature excludes use of experimental paradigm on practical, ethical and methodological grounds. However, researchers will find descriptive or investigative (case studies) most useful research paradigms. If researchers and practitioners take the time to reflect systematically on their experience, it will be possible to expand the empirical base of the field (Foshay & Moller, 1992).

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# THREE APPROACHES TO TEACHING THE SAME SUBJECT AT TWO UNIVERSITIES

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*A collaborative effort was established between two major universities to teach a particular subject. The course was taught 3 different ways: full collaboration, half collaboration, and a traditional method. This paper will discuss the methods used and why it was implemented and organized in this manner.*

## Background to the Course

In the fall of 1997, a senior level course was taught as an interdisciplinary class for learning the processes in food product development. The course implemented many new teaching methods and technologies. It was an effort between two departments: food science and agricultural economics. Students worked in teams with industry mentors who assisted in elaborating on some of the procedures involved in the development process of food products. It was intended to take this class beyond the walls of Penn State in the Fall of 1998 and include some other locations. An opportunity arose to link up with students in a food marketing class in St. Joseph's University. This opportunity included finding ways to share resources and for the students to get involved with each other. Speakers were shared and some collaborative work was done during the 1999 year using PictureTel. The classes were scheduled for the same time of day to facilitate cooperation.

Fall semester of 2000, it was decided to take the process a step further and truly integrate the teams for working on projects and assignments. Teams were formed to work together on the course project. There were three different versions of the course. One course is totally integrated. The second version will share the speakers and have some lectures on the off days. And, the last one was left alone to be taught traditionally with lecture and few outside speakers or influences. All three used case studies to assist in the learning process. In all three cases the students were asked to create concept maps and take a mini knowledge test to be used in the evaluation process of understanding concepts before and after the course.

## Aspects of the Fully Collaborative Course

There are several distinct features of the fully collaborative food product development course. The course was originally conceived to apply principles of constructivist theory. In this approach, prior knowledge and experience is the springboard for useful, personal knowledge construction. "Constructivist learning experiences and appropriate classroom practices include reflective thinking and productivity; authentic activities, including student collaboration and consideration of multiple perspectives, and student access to content area experts who can model domain-specific skills." (Grabe & Grabe, 1998) Course organization was based on the idea that the students would be able to reflect on situations and environments in order to make application towards the course project.

Jonassen (1996) also has much to say about constructivist learning environments. "Constructivist environments facilitate learning through collaboration, context, and construction of knowledge. Through assimilation and accommodation, individuals use many elements of the learning context and relate those elements to their own experiences thus creating new knowledge". Constructivism does not always produce predictable learning outcomes. Instruction should foster the constructive process of the learner, and not attempt to closely control the process or result. The process of instruction and role of instructor should be as a guide to discovered knowledge. There was not a specific result desired in the course rather a process that was to be fine-tuned. Contextual situations were provided with the case studies and industry speakers. The use of case studies was implemented to assist in developing critical thinking. Students were expected to apply prior knowledge and seek out new knowledge to fill in the gaps that may rise up as they worked through various case studies.

## **Objectives**

1. To comprehend the fundamental principles, generalizations and theories of product development.
2. To understand the specific skills, competencies and points of view needed by product development professionals.
3. To appreciate the interdependencies of finance, formulation, marketing, packaging, process engineering, production and quality assurance in the development of food products.
4. To better understand how food company managers gain knowledge about the process for developing food products.
5. To develop skills in analyzing ill-defined opportunities and developing strategies to resolve them.
6. To develop the competencies of effective communication and negotiation skills when working within groups/teams.
7. To develop the ability to be a self-regulated learner who can engage in both constructive and critical self- and peer-assessment.
8. To enhance the ability to use contemporary communications and information technology. To enhance oral and written communications skills.

## **Use of Case Studies**

Wilson (1996) defines a constructivist learning environment as: "a place where learners may work together and support each other as they use a variety of tools and information resources in their guided pursuit of learning goals and problem-solving activities" (p.5). He emphasizes learning environments as opposed to 'instructional' environments in order to promote "a more flexible idea of learning", one which emphasizes "meaningful, authentic activities that help the learner to construct understandings and develop skills relevant to problem solving" (p.3).

Case studies have the capacity to engage students in the thinking process. Case-based reasoning is a cyclic and integrated process of solving a problem, learning from this experience, and solving new problems. The roots of case-based reasoning can be found in the works of Roger Schank on dynamic memory and the central role that a reminding of earlier situations (episodes, cases) and situation patterns (scripts, MOPs) has in problem solving and learning (Schank, 82). Each section of the case takes the student into new areas of cognitive exploration. Presenting the cases on the web as opposed to a written format provides the students with opportunities to explore and select particular information. Information that is presented without any direct and interactive activity will often pass right through their head without any processing or application. They are not likely to change the way they view a particular situation as a result of merely hearing the information. Due to the nature of most web pages, students' minds will race past topics in rapid succession with little time or opportunity to think, reflect or develop meaning. Their cognitive skills are only apparent on a scattered layer of thinking. They are forced to adopt a surface approach to their learning. Students are typically in a survival mode to read, memorize and reiterate the information in some sort of examination process.

Some of the problems of student understanding and learning can be enhanced through the use of alternative teaching approaches. This paper discusses a model used to promote critical thinking on the web using case studies. Aside from the basic issue of facilitating effective learning, there is a need to develop in students a method for problem-solving that will be useful in "real world" examples.

## **Interactive Aspects**

Interactivity in the course invites the students to participate and become part of what is going on with the industry and the people influencing it. The cases were written for this class with the goals of instruction in mind. Each case had its own particular items that provided twists in the development process. Some gave the students very difficult decision points that required outside sources to gain more insights on the subjects. Students worked both individually, and, in groups to share ideas and solve the problems. Experts in the field were brought in through face-to-face presentations or over PictureTel

sessions. Email and phone calls were also used to give the students access to probe and investigate some of the key points in the case as well as questions related to their projects. Cases were shared with a discussion from both the instructor and student view.

### **Stimulating Learning**

A great deal is known about factors that affect learning and in particular factors that facilitate a deep approach to learning. There are some specific methods that can be used to motivate students. Case studies provide the opportunity for critical thinking since they only provide part of the information needed to complete the exercises. Students will:

- formulate questions that relate to the current case
- construct knowledge while they are engaged in problem solving
- build on and diffuse what they already know
- have the opportunity to discuss, explain, write and reflect on the new knowledge
- experience some control over what, when and how they are learning
- have an opportunity to consider new possibilities
- receive feedback regarding their learning

Learners actively take knowledge, connect it to previously assimilated knowledge and make it theirs by constructing their own interpretation. Students will read a case with their own experiences and a cognitive structure based on those experiences. These structures can be valid, invalid or incomplete. The learner will reformulate his/her existing structures only if new information or experiences are connected to knowledge already in memory. The learner must actively construct new information onto existing mental framework for meaningful learning and problem solving to occur.

### **Selection of the Tools**

Select appropriate online technologies such as video and audio conferencing, computer-mediated conferencing, Internet access, bulletin boards and news groups, and e-mail to support teaching and learning strategies. A short discussion of each tool and reasons to use them will follow.

<b>TOOL</b>	<b>BENEFIT</b>
Video and audio conferencing	Provides visual and audio cues
Computer-mediated conferencing	Initiate discussions
Internet access	A wealth of resources
Bulletin boards and news groups	Others interested in similar discussions
E-mail	Direct contact with teachers, students, and speakers

Tools to promote higher-order thinking should be used in this constructivist process. It is not only essential to place the students in a rich environment full of new technologies, but to provide a means and reason for using the tools. PictureTel was selected as a video conferencing method since both universities had access to it. It was used at least once a week in order to share speakers and provide access for group communication. CourseInfo was used as a course management system with advanced architecture that allowed for Web-based integration and administrative systems. This provided the framework for communication with the students and amongst the students. Students used the online system to have discussions and share information with other team members. Faculty used the system to post assignments and information.

### **Evaluation of Student Performance**

Students were evaluated and the course grade assigned based on the following:



Individual Performance		Team Performance	
<b>Final Examination</b>	<b>15%</b>	<b>Progress Report: Oral</b>	<b>15%</b>
<b>Peer Evaluation of Collaboration on Team</b>	<b>20%</b>	<b>Final Report: Written</b>	<b>20%</b>
<b>Participation</b>	<b>15%</b>	<b>Final Report: Oral</b>	<b>15%</b>
<b>TOTAL</b>	<b>50%</b>	<b>TOTAL</b>	<b>50%</b>

The Final Examination (15%) is a description of the product development process for a specific food product opportunity. Peer Evaluation of Collaboration on Team (20%) is accomplished by asking students to rate their team members on eight different parameters and then to offer an overall weight by assigning the portion of a \$10,000 bonus to be distributed to each team member. This evaluation will be done twice during the semester and at the end of the semester.

The Progress Report (15%) is a team-based oral presentation simulating the product development team's presentation of its plans to the firm's upper management for a 'go-no go' decision. The Final Report (35%) is their team's presentation of the food product innovation to retail buyers.

### **Aspects of the Partially Collaborative Course**

The class in this partially collaborative course was taught at St. Joseph's University. It consisted of a combination of lecture, presentations, discussion and exercises. Guest presentations from food industry professionals were provided. The major emphasis of the course was on the new product planning process and to that end, each student was assigned to a student team. Each team took on the identity of a food processing company and was challenged to identify a new product opportunity, conceive a new product, and develop a launch program to support introduction of this new product to the supermarket trade. Both a written paper and a formal oral presentation were required of each student team. The final presentations were made to a group of retail category managers. The final presentations were held during the scheduled time for the final exam.

### **Course Objectives**

1. To develop skills necessary to be a contributing member of a team.
2. To enhance oral and written communications skills.
3. To develop skills in analyzing ill-defined problems and developing strategies to resolve them.
4. To better understand how food company managers gain knowledge about the process for developing food products.
5. To comprehend the fundamental principles, generalizations and theories of product development.
6. To understand the specific skills, competencies and points of view needed by product development professionals.
7. To appreciate the interdependencies of finance, formulation, marketing, packaging, production and quality assurance in the development of food products.

### **Class Format**

The class format consists of a combination of lecture, presentations, discussion and exercises. The instructor will endeavor to provide guest presentations from food industry professionals on at least a couple of occasions.

### **Assignments and Grading Policy**

This course is primarily a team-based course. Each student had one major individual task – a midterm examination. The bulk of the grade was determined by the quality and completeness of the work on the semester project. The grade was determined as follows:

Midterm examination.....	40%
Individual grade on NPD project .....	50%
The project grade will be divided into two components, the preliminary presentation to the management committee (1/3) and the final presentation (1/3) and comprehensive team paper (1/3.)	
Contadina case (special project).....	10% *

**\*If you opt NOT to participate in the Contadina special project, you will**  
need to complete a short research paper on a topic assigned by the instructor.

Note: The individual grade for team assignments will be the team grade multiplied by an index number which reflects the quantity and quality of your contribution to the team effort.

The project consists of several parts, including a (1) company review and assessment, (2) category assessment, (3) concept development and screening, (4) product development and testing and (5) introductory marketing program and launch plan. Class time will be used to discuss more specifics about the project and details on the midterm and the project. The paper is due at the time of the final presentation.

## Aspects of the Traditional Course

The third course was taught in a more traditional mode. There were lectures, tests and a project. This class also participated in some of the PictureTel sessions with the industry speakers.

## Course Objectives

1. To comprehend and apply the fundamental principles, generalizations and theories of product development.
2. To understand and apply the skills, competencies and viewpoints needed by product development professionals.
3. To appreciate the interdependencies of R&D, manufacturing, finance, marketing and sales in the development of successful food products.
4. To develop skills in analyzing and taking advantage of ill-defined opportunities.
5. To understand the risks and rewards associated with new food products.
6. To enhance personal skills: team work; oral presentation; written presentation; selling.

## Grade Components and Weights

Semester Project: Written:	40%
Oral:	20%
Special Semester Project:	10%
Class Participation:	15%
Midterm Examination:	15%

## Semester Project

The course has three major emphases: developing a new food product; selling the concept to top management; selling the product to the retail supermarket trade. Each student was assigned to a team. Each team will select and assume the identity of a food manufacturing company and will: identify a new product opportunity; conceive a new product; and develop a launch program to introduce the new product to consumers in coordination with the supermarket distribution channel.

Each team submitted a written paper of 20 pages or less, excluding appendices, detailing its new product development and launch programs. The paper was due on December 6. An in-process draft was due on November 21.

Each team prepared a sell-in presentation to be made to a panel of grocery category managers in December, exact date and place to be determined.

## **The Study**

This study is primarily looking at the differences in learning using different teaching methods. The evaluation of the students was essential to measure those differences. There was a pre-test and a post-test to assist in analysis. Many methods were implemented that will be discussed.

### **Conventional Teaching**

There are typical elements found in conventional teaching practices. The curriculum content is usually fixed and presented in linear and sequential ways. A path of learning is established and sequentially used for the course. Mastery of existing knowledge and concepts is sought before students are led to the next set. Typical activities involve learning tasks that are segmented and fragmented to make them more easily achieved. These can include reading and lectures relevant to each particular subject. The activities tend to lack any real life context and are usually presented in abstract forms bearing little relevance to settings beyond the classroom. In most cases, the teacher plays the role of the expert delivering knowledge to the learners. Learners act in passive modes working individually to complete the set tasks. Assessment of learning is done through pencil and paper tests measuring competency in the various elements of the curriculum.

Learners have frequently been found to be incapable of applying and transferring the learning to practical settings. Learning has been found to be temporary and short-lived.

### **Active Learning and Teaching Methods**

For some time now, educational researchers, classroom teachers and curriculum developers have been exploring ways to increase the effectiveness of teaching programs and in particular, classroom learning. The learning theories have always suggested that what is needed is more active involvement of the learners in the learning process. Theories of learning have been developed which explain the way in which learning is achieved through knowledge construction. The integral role of communication between learners has been explored and the value of collaboration and co-construction of knowledge developed. At the same time, curriculum developments have moved from descriptions of the content to be learned to environments where outcomes of learning have been made discrete. The role of assessment has been recognized and given a more fundamental place in the learning process. The sum of these developments suggests a changed direction for educational planning.

### **Changed Roles for Learners**

The first thing often observed about learners in an active learning environment is the degree of self-regulation and self-determination. Students are expected to search for meaning throughout the course through resources provided. Formal structures are removed and students are free to make their own connections and pathways. Some of these include:

- Freedom of Information

Information is provided in an open setting such as the web, speakers, case studies and the course faculty. A book is also used in this setting to provide examples and more detailed explanations. Much of

the information that was gathered by the students came from prior experience, discussions, web pages, speakers, interactions with the faculty and cross-institutional dialog.

- **Active Learners**

Students are encouraged to collaborate and work together. The environment is usually one of a shared learning space with learners attentive and receptive to others in the class. Students are asked to solve problems and ask questions. They are expected to work with the other students in their group to accomplish tasks.

- **"Real-life" Activities**

Activities in class encourage and support such strategies as problem-based learning, case-based learning and presentations from those in the industry. The concept of a classroom as a place of learning is expanded as the classroom loses its boundaries. Each case study was written with the specific goals of the course in mind. It was important to provide examples of the various stages in the food product development cycle so that the students could make application toward their final project.

### **Changed Roles for the Teachers**

Teachers in active learning environments differ in terms of their roles and responsibilities. The differences appear in how they interact with their learners and how they manage and implement their learning settings. Some of these roles include:

- **The Coach**

Their role is that of a guide or a coach. They provide the learners with access to a variety of independent learning experiences. There are minimum times that there is a need for lecturing or other forms of teacher-directedness in these settings. The most active person in the environment is the learner and often the teacher is a spectator of learning shouting advice from the sidelines.

- **Instructional/Learning Designer**

The teacher will play a vital role in designing the learning activities and developing creative ways to involve the students. Instead of only considering what is being taught, the teacher has to be thinking of how it is taught and what the possible outcomes will be.

- **Assessment**

The move to an outcomes-oriented approach carries with it changes to assessment strategies. These strategies reflect how the learning is to be used. Some of these approaches include teamwork strategies, case study analysis, projects, presentations, and summary papers.

### **Summary**

The three courses will be used to make comparisons in the teaching methods to find differences in outcomes for the students. Each course contains components of constructivism in the approach to teaching especially regarding the use of case studies. The major differences are the methods of learning and the involvement of the students in the learning process. Students will be surveyed at the end with another concept map and mini test to compare the results from the beginning of the class to the end. The knowledge presented was similar, but the methods used were extremely different. Some of the questions to be answered regard the depth and application of the concepts that are obtained.

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# COMPUTER-BASED TOOLS TO SUPPORT CURRICULUM DEVELOPERS

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Since the start of the early 90's, an increasing number of people are interested in supporting the complex tasks of the curriculum development process with computer-based tools. 'Curriculum development' refers to an intentional process or activity directed at (re) designing, developing and implementing curricular interventions in schools, colleges, or corporate education. The term 'curricular intervention' serves as a common denominator for curricular products, programs, materials (varying from teacher and student/trainee materials), procedures, scenarios, processes, and the like. A key issue and major challenge in curriculum development is how curricular interventions should be developed in order to achieve a satisfying balance between the ideals of a curriculum change and their realization in practice. This paper provides background information on the roots of computer-based tools for curriculum developers, provides an overview of those tools currently available in the USA and abroad (especially Australia and The Netherlands) and describes probable future trends.

## 1. Roots of Computer-Based Tools for Curriculum Developers

Many designers make use of tools or job aids providing design support in their daily work. A job aid is a collection of several kinds of conceptual or procedural information (for instance: glossaries of terms, guidelines, decision tables, checklists) that supports work. Over the years, many of these job aids have been combined into handbooks for instructional designers. According to Rossett and Gautier-Downes (1991), job aids may have major advantages for their users, such as:

- they are available at the moment individuals feel a need for them;
- they increase the chance that an individual has up-to-date information to perform a task, especially in case of a very complex and infrequently performed activities;
- they prompt individuals through difficult processes and decisions.

Computer-based technologies have not only influenced the domain of job aids. They have also impacted other types of external support, such as communication and training. Today's computer and networking facilities can even integrate these types of performance support. Instead of separately providing different ways of support to individuals, an electronic performance support system (EPSS) provides integrated information, advice and learning opportunities to improve user performance (Gery, 1991; Raybould, 1995). EPSSs are given many names, such as performance support tools (Carr, 1992), (integrated) performance support systems (Geber, 1991), embedded performance support systems (McGraw, 1995). But regardless of the terminology used, they all refer to a computer-based system which provides integrated support in the format of any or all of the following: job aids (including conceptual and procedural information and advice), communication aids and learning opportunities to improve user performance.

With the increase of the number of computers used at work, a growing number of computer-based tools for designers and developers in education and training have been developed at various places around the world. More efficient development processes, more effective learning programs and increasingly competent designers are all potential benefits that make these tools attractive to many designers and their managers. In addition to these assumed advantages, some criticism may also be found in literature. Firstly, the potential supportive role of these tools should be carefully judged. For instance, as the consultation of an EPSS is usually largely self-directed, certain capacities of the individuals who use the EPSS are required: they need to know what they do not know; value a high degree of control and be able to evaluate

the quality of the information, to name just a few characteristics. Not every individual possesses these cognitive as well as affective characteristics. Moreover, Clark (1992) suggests that in many dynamic work environments, individuals do not have the time to look for information in the job aids or learn from the CBT component of an EPSS. Developers of EPSSs and organizations who consider using these tools should take these potential problems into account.

## 2. Overview of Available Tools

In order to get an overview we examined the following available tools: GAIDA, QIPP EPSS, PLATO, MediaPlant, SimQuest, CASCADE-SEA, TeleTOP DST, Mercator, IDXelerator, AGD and GTE. In box 1 each tool is briefly introduced. For more information please refer to the references of each tool.

**GAIDA:** Guided Approach to Instructional Design Advising (GAIDA) offers on-line elaborated guidance for the application of Gagné's nine events of instruction (e.g. Gagné, Briggs & Wager, 1992) to the design of interactive courseware and other instructional materials. GAIDA was developed for novice instructional developers at the Air Force Research Laboratory (Gettman, McNelly & Muraida, 1999).

**QIPP EPSS:** This tool supports the application of a new development methodology (called Quality Information Products Process) for designing technical documentation at NCR. The system specifies phases and work activities of the instructional design process and provides job aids for each activity. Technical writers and instructional designers of NCR belong to its main target group (Jury & Reeves, 1999).

**Plato Courseware Development Environment:** Plato is an authoring tool to support the design and development of courseware including tutorials, simulations and constructivist learning environments. The systems can be used by non-programmers to author instructional activities by customizing objects that are copied from a library and assembled into completed multimedia components. For each phase of the process there are job aids accessible to all members of the design team (Preese & Foshay, 1999).

**MediaPlant:** This is a development environment that facilitates the production of complex cross platform learning environments. The development program is used to construct and test the learning environment, which is then distributed with the runtime program (Wright, Harper & Hedberg, 1999).

**SimQuest:** This is an authoring environment for creating learning environments that combines simulations with instructional support that helps learners in the process of discovery learning. An author (teacher) creates a learning environment by adapting building blocks selected from a library. The author gets support from an on-line help system, a wizard and an advice tool (de Jong, Limbach, Gellevis, Kuyper, Pieters & van Joolingen, 1999).

**CASCADE-SEA:** CASCADE-SEA (Computer Assisted Curriculum Analysis, Design and Evaluation for Science Education in Africa) aims to support curriculum development within the context of secondary level science and mathematics education in sub-Saharan Africa. One of its components is called "lesson builder". This component has been designed to help teachers make paper-based exemplary lesson materials. Based on input of the user, Lesson Builder's prompt the program to generate a draft (McKenney, 1999).

**TeleTOP DST:** The TeleTOP Decision Support Tool is a WWW-based environment that helps instructors become aware of technical possibilities for their courses and helps them to see how these could be integrated in an educationally useful way (Collis & de Boer, 1999).

**Mercator:** This system supports the design, production and delivery of course materials. On the one hand it helps to design and produce the material, and on the other hand it helps students to select specific materials and supports the actual delivery in a printed and/or electronic mode (Valcke, Kirschner & Bos, 1999).

**IDXelerator:** This authoring system automatically generates the instructional interactions required for the student to acquire a specific kind of knowledge or skill. The system has an author view (that supports the author) and a student view for delivery of the instruction (Merrill & Thompson, 1999).

**AGD:** Atelier de Génie Didactique provides a pedagogical design assistant to content experts in companies and university teachers in preparing lessons for distance learning settings (Paquette, Aubin & Crevier, 1994; Spector; 1999).

**GTE:** The Generic Tutoring Environment is focused on providing support for designing intelligent tutoring systems. The primary task of such systems is to integrate instructional knowledge in the system in a way that allows the system to adapt to learners just as expert teachers do (van Marcke, 1998; Spector, 1999).

Box 1. Brief description of computer-based tools to support curriculum developers

From the short overview in box 1 it becomes clear that available computer-based support tools for developers in the field of training and education can be classified in many ways. To analyze the tools in more detail we used a framework with the following set of attributes:

A. Type of output:

- Curriculum level (few lessons, product, course, collection of courses)
- Characteristics of results (target group, form, extensiveness)

B. Purpose and evidence of benefits:

- Purpose (transfer of knowledge and skills, improved task performance, organizational learning)
- Evidence of claimed benefits (validity, practicality, effectiveness)

C. Type of development process supported and any underlying theory:

- Paradigm for engaging in education and training benefit (instrumental, communicative, pragmatic, artistic)
- Elements of systematic approach (analysis, design, development, implementation, evaluation)
- Underlying teaching/learning theory (behaviorism, cognitivism, constructivism)

D. Task support:

- Types of support (communication aids, job aids, training aids)
- Adaptability of support (outside the tool, inside the tool, inside networked tool, closed)

E. Intended user group:

- Expertise of user group (professional designer (ISD), subject matter expert, teacher, learner)
- Scope of intended user group (various organizations, specific organization)
- Computer experience (low, high)

The framework was used to examine the tools for developers mentioned in box 1 (see Table 1). The framework should be judged solely on its utility as a schema for examining and selecting from among tools and is not intended to be a scientifically valid taxonomy. Moreover, it should be noted that the analysis is based on limited information provided by the developers of the tools and is not based on personal experience with most of the tools. For an individual who wants to select a tool based on the information in the framework, technical issues such as needed operating system, software; and hardware would be critical to consider as well. The same is true for other issues such as time needed to learn the tool; time needed until a user starts to be productive with the tool; the costs of a tool; and its general availability.



		<b>GAIDA</b>	<b>QIPP</b>	<b>PLATO</b>	<b>MediaPlant</b>	<b>SimQuest</b>	<b>CASCADE-SEA</b>
<b>A</b>	Curriculum level	Product	Product	Product	Product	Product	Course and lesson
	Characteristics of results	- Learner-based - Site-specific - Paper-based/ Computer-based	- Learner-based - Site-specific - Paper-based	- Learner-based - Generic - Computer-based and Web-based	- Learner-based - Site-specific/ Generic - Computer-based	- Learner-based - Site-specific/ Generic - Computer-based	- Learner-based Teacher-based - Site-specific - Paper-based
<b>B</b>	Purpose of tool	- Better transfer - Performance improvement	- Better transfer - Performance improvement	- Performance improvement - Organizational learning	- Performance improvement	- Better transfer - Performance improvement	- Better transfer - Performance improvement - Organizational learning
	Evidence	Results available	Results available	Results available	IIA	IIA	IIA
<b>C</b>	Development paradigm	Instrumental	Pragmatic	Pragmatic	Pragmatic	Pragmatic	Pragmatic
	Elements of systematic approach	- Design	- Analysis - Design - Development - Implementation - Evaluation	- Analysis - Design - Development - Evaluation	- Design - Development	- Design - Development	- Analysis - Design - Development - Implementation - Evaluation
	Teaching/learning theory	Behavioristic	Cognitivist	Cognitivist	Constructivist	Cognitivist	Cognitivist
<b>D</b>	Types of support	- Job aid: toolbox	- Job aid: toolbox, do-it-yourself kit	- Job aid: toolbox, do-it-yourself kit - Communication aids	- Job aids: do-it-yourself kit	- Job aids: do-it-yourself kit	- Job aid: toolbox, do-it-yourself kit
	Adaptability of support	Closed	Inside networked tool	Inside networked tool	Inside tool	Inside tool	Inside tool
<b>E</b>	Type of user group	- SME's	- Designers	- Team with range of roles	- Designers - Learners	- SME's - Teachers	- Teachers
	Scope	Various organizations	One organization	Various organizations	Various organizations	Various organizations	Various organizations
	Computer experience	Low	Medium	High	Medium	Medium	Low

**Table 1 continues**

		<b>DST</b>	<b>Mercator</b>	<b>IDXelerator</b>	<b>AGD</b>	<b>GTE</b>
<b>A</b>	Curriculum level	Course	Course	Product	Course	Course
	Characteristics of results	- Learner-based, Teacher-based - Site-specific - WWW-based	- Learner-based - Site-specific - Paper- /Computer-/ Web-based	- Learner-based - Site-specific - Computer-based	- Learner-based, Teacher-based - Site-specific - Computer-based	- Learner-based - Site-specific - Computer-based
<b>B</b>	Purpose of tool	- Performance improvement	- Performance improvement	- Performance improvement	- Better transfer - Performance improvement	- Performance improvement
	Evidence	Results available	Results available	IIA	IIA	N/A
<b>C</b>	Development paradigm	Pragmatic	Instrumental	Instrumental	Pragmatic	Instrumental
	Elements of systematic approach	- Design	- Design - Development	- Development	- Analysis - Design	- Analysis - Design - Development
	Teaching/learning theory	Cognitivist	Cognitivist	Behavioristic	Cognitive	Cognitivist
<b>D</b>	Types of support	Job aid: automatic washing machine	Job aid: do-it-yourself kit	Job aids: automatic washing machine	Job aids: toolbox	Job aid: toolbox, automatic washing machine
	Adaptability of support	Closed	Inside tool	Closed	Closed	Closed
<b>E</b>	Type of user group	- Designers - Teachers	- Designers	- SME's	- SME's	- Teachers
	Scope	Specific organization	Various organizations	Various organizations	Various organizations	Various organizations
	Computer experience	Low	Medium	Medium	Medium	Medium

Note: IIA = Insufficient Information Available

**Table 1. Conceptual framework**

Here we provide a brief interpretation of the analysis.

#### **A. Type of Output**

In general, the use of most of the tools results in instructional products or courses that are computer-based and have learners as their main target group. Although it might be argued that many, if not all, of the tools could be used for creating many different forms of instruction, they do appear to lend themselves best to one or only a few forms of output. None of the systems seem to focus primarily on the development of interrelated collections of courses. Only a few of them may lead to paper-based materials (GAIDA, CASCADE-SEA and Mercator), and/or web-based materials (PLATO, DST, and Mercator) and only three tools support the development of teacher-based materials (CASCADE-SEA, DST, and AGD).

#### **B. Purpose of the Tool**

Generally speaking, all tools are designed with the expectation of improving the performance of developers of training and education. In describing the tools, some authors anticipate that their tool will lead to a better transfer of knowledge and skills to the actual task performance because it makes the rationale of the tool (and thus that of the design process) explicit (cf. QIPP, SimQuest, CASCADE-SEA, and AGD). Others expect that the use of their tool will lead to organizational learning, since the tool invites users to make newly acquired information available to their whole organization (PLATO and CASCADE-SEA). However, it should be noted that most of these claims appear to remain assumptions, since few data are available that demonstrate the actual benefits of these tools.

#### **C. Type of Process Supported and Underlying Theory**

Many tools that were analyzed make extensive use of a prototyping approach, which refers to a pragmatic paradigm. This is, with the exception of GAIDA, Mercator, IDXerator and GTE: these tools seem to be based on a paradigm that follows a more linear completion of the instructional design process.

When looking closer at the underlying elements of the systematic approach to development of education and training it appears that two tools (QIPP and CASCADE-SEA) intend to support the designer during the entire process (from analysis through evaluation). All other tools support specific elements of the process, of which design and development get the most attention. When reviewing the tools with respect to the underlying teaching/learning theory, it appears that most tools are based (to various degrees) on a cognitivist theory. Two tools seem to be based on a more behavioristic theory (GAIDA and IDXerator) and one starts from constructivism (MediaPlant).

#### **D. Task Support**

All tools contain job aids to support users in their development activities. The metaphor of a toolbox and a do-it-yourself kit fits most tools. None of the systems that were analyzed have the ability to automate the entire instructional design process. In all cases, considerable human skills are needed to make effective instructional products and courses. It is noteworthy that none of the tools seem to include explicit learning facilities for designers who express a need for learning a specific design task. For novice designers, with the possible exception of GAIDA, the tools seem to count on an informal learning process of learning-by-doing or some form of external assistance.

#### **E. Intended User Group**

Generally speaking, it appears the designers of all tools started creating the tools with a specific organization in mind. In an overall view, the tools are intended for one or two of the following user groups: professional designers, subject matter experts, teachers and/or learners. This means that the support tools need to contain (parts of) team members' expertise that would have been needed in times when the tool was not available.

### **3. Trends in Computer Supported Curriculum Development**

In looking ahead, there are several trends that will impact the form and substance of future computer-based tools for developing education and training.

### **Supporting a Constructivist Perspective on Learning**

The increased influence of the constructivist perspective on learning is impacting the design of computer-based support tools. From this perspective, learning requires active construction rather than acquisition of knowledge by the learner. As a consequence, the teacher will increasingly become a designer of learning environments that support the construction of knowledge of the learners. Also, teachers or trainers increasingly fulfil design roles in the context of innovative projects, in which they participate, often emphasizing their own professional development.

### **Increasing Array of Tools**

The first tools were almost all created to support only one or a few tasks related to the curriculum design process. Although there are now some tools that support many different tasks, none are completely adequate for all tasks on different types of projects. What we now see is expansion in several directions: there is an increase in the number of tools that attempt to integrate multiple tasks, however, at the same time the number of single purpose tools for highly specialized situations is also increasing. Continuing advances in computers, digital processing, and communication technology will all add to the demand for a complementary set of development tools and support new features related to future design efforts.

### **Supporting Teamwork**

Team efforts are increasingly critical to large scale, complex projects, especially those that will result in technology-based instruction such as multimedia or web-based course. As a consequence, computer-based support tools may be extended with communication tools that facilitate collaboration. In addition, anticipation of how the curriculum intervention will be implemented is of growing significance during the design process.

### **Supporting Networks of Designers**

As individual designers gain knowledge and skill in using the tools they can more readily share this knowledge with other members of the design community to prevent these insights and skills from being lost to others or not be otherwise leveraged in the organization. Based on today's database and networking technologies, effective computer-based infrastructures may be developed which makes knowledge sharing and knowledge management more possible.

For all of these reasons, we believe the future of computer-based support tools is very bright. The emergence and expansion of tool creation and use that we have witnessed over the last ten years will pale in comparison to what will happen during the next decade. We have no doubt that future tools will be as different from current ones as current desktop computers are from their predecessors of ten years ago. Continuing advances in computers, digital processing, and communication technology will both add to the demand for a complementary set of development tools and support new features we can only dream about today.

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# INFLUENCES OF CONCEPT MAPPING AND LEARNING STYLES ON LEARNING

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The effect of concept mapping with different levels of knowledge to assist those with different learning styles will be discussed. This paper will discuss the methods used to compare these influences and the differences in particular learning processes.

## Concept mapping

Concept mapping is a technique for visually representing the structure of information, concepts and the relationships between them. They can be compared to road maps that help us find direction in the midst of numerous signs, roads, and other distractions. Substantial changes in the complexity of the knowledge structures take students beyond rote learning toward meaningful learning. Students using concept maps increase their domain knowledge (Ruiz-Primo & Shavelson, 1996) toward applications and assessments.

Concept maps are useful tools that help students learn about how they structure knowledge while supporting the process of knowledge construction or metaknowledge. In this way, concept maps help students learn how to learn commonly referred to as metalearning. A concept map requires the learner to function at all four levels of Merrill's (1983) content dimensions: fact, concept, procedure, and principle. Each of these dimensions identifies three performance levels: remember, use, and find. "Remember" causes the students to search their memory in order to reproduce or recognize a previously stored item. "Use" will require the student to apply some abstraction to a specific case. Use means to use a general rule to process specific information. Finally, "find" is the performance level that the student begins to derive or invent a new abstraction.

The concept map becomes an external representation presenting internal processes of information in structured graphs (Jonassen, Beissner & Yacci, 1993). It becomes a representation of the application of the dimensions of conceptual processes at different content levels. The nodes and links represent relationships between the concepts and demonstrate the depth of processing knowledge. Conceptual understanding can be described as the richness of interconnections and relationships made between concepts and the structure that organizes those concepts (Novak & Gowin, 1984).

Concept maps have been used successfully to promote learning. How do students internalize and organize readings, assignments and notes to prepare a concept map as a study tool for a test that evaluates different levels of learning? How do they process new facts, concepts, etc., to complete assignments and take tests? Can a concept map be a significant factor in facilitating different levels of learning? Will different learning styles affect the strategies used in creating a concept map and the follow-through when given a test on the subjects?

## Learning Styles / Cognitive Styles

Attempts to describe patterns of information processing have led to the development of several theories in the field of educational psychology (Noring, 1993), but most commonly these approaches have been divided into two broad classes of learning styles (also called cognitive styles, see Kearsley, 1994), known as field dependent and field independent. Field dependent learners, the most prevalent, need to see each segment of instruction in relation to the preceding instruction and the overall aims of the course. Field independent learners, on the other hand, are apt to find their own structure in which to place the instruction and other, extraneous applications for the instruction. Whereas field dependent students learn best the material presented within its social context, field independent learners prefer a more clinical, analytical

presentation of material, and learn social material more as an intentional task than a natural response. In place of the external goals and reinforcements desired by the field dependent learner, the field independent student values knowledge for its' own sake, and often has a personal set of goals and rewards to strive for.

Differences in cognitive styles do not indicate differences in learning ability or memory (Witkin, Moore, Goodenough, and Cox, 1977). Cognitive styles indicate the preferences that an individual has for perceiving and processing information, not the ability to learn the material. Thus, students with equal learning abilities but different cognitive styles may experience different levels of success in the same environment.

## **Meaningful Learning**

The idea behind concept maps was derived from Ausubel's theory of meaningful versus rote learning. Meaningful learning occurs when students intentionally attempt to integrate new knowledge with existing knowledge. A learner who attempts to integrate knowledge will most likely have a more extensive network of knowledge and therefore more retrieval paths. His subsumption theory involves reorganization of existing cognitive structures not development of new structures. A primary process in learning is subsumption in which new material is related to relevant ideas in the existing cognitive structure on a substantive, non-verbatim basis. Cognitive structures represent the residue of all learning experiences; forgetting occurs because certain details get integrated and lose their individual identity.

Rote learning occurs because a student simply memorizes information with no attempt or motivation to relate that information to prior knowledge. Therefore, the rote learner will have a less extensive network than the meaningful learner and less retrieval paths between knowledge concepts. Concept maps are one way to foster and measure meaningful learning in the classroom as instructional, student learning, and assessment techniques.

Instructionally, concept maps foster meaningful learning by teaching the connections among course concepts. As a student learning tool, concepts maps promote meaningful learning by encouraging the students to generate their own connections between concepts. In terms of assessment, concept maps evaluate if and how meaningful learning is occurring.

According to Ausubel's (1963) Meaningful Learning Theory, we build meaning every time we establish substantive rather than arbitrary relationships between the study material and existing knowledge. When students encounter new material they approach it from a series of concepts and representations acquired from previous experiences. These experiences are used as instruments of interpretation that partially determine what information the students will absorb, how they will organize the information, what types of relationships they will establish among the pieces of information, what problem-solving techniques they will use, and so on.

This explains why the concepts do not represent the same for the teacher as for the student—the concepts have neither the same relevancy nor the same explanatory power. Ausubel argues that when discipline is taught, it fundamentally transmits this conceptual structure to the students.

The appropriation of complex structures of knowledge implies an understanding of them, and that understanding cannot be reached only by routine procedures. The acquisition and retention of a body of knowledge implies the assimilation of a body of conceptual meanings—the product of meaningful learning.

In Ausubel's words, concepts are acquired by progressive differentiation—that is, those concepts that are ordered in a hierarchy that progresses from the most general to the most specific idea. New information is assimilated into existing conceptual hierarchies in the cognitive structure. These modifications are not merely juxtapositions of concepts, because the final meaning of a structure is not equivalent to the sum of the parts—it forms a new structure.



In the psychological structure, a related process of integrative reconciliation occurs that allows knowledge to relate to the discipline and modify preconceptions or misconceptions, thus reducing fragmentation and making possible a reflective and critical attitude.

The existing structure of knowledge influences the capacity to interpret reality and to take part in it. It creates a framework that will open or shut depending on the individual's capacity to understand. This capacity to approach and solve problems depends on the density of meanings in the existing structure of knowledge. There will be dominant areas in which the effect from an experience is quite broad and for which the structure of meanings is exceptionally powerful, and there will be others in which precisely the opposite happens.

From this perspective, attending to the potential of the study material to develop thought skills implies two things. First, the knowledge must be organized with the discipline and its methodology following a hierarchical relation scheme that is part of the most general and most inclusive concepts of the material and advances toward the most particular. This descending cyclical sequencing allows us to put relief in different relationships that maintain the concepts among themselves. Effective linkage results in subsumption; that is, new knowledge is meaningfully joined with other knowledge in the student's cognitive structure. Second, it must facilitate the assimilation of concepts (the progressive differentiation and the integrative reconciliation) through:

- the initial presentation of general ideas that provide one conceptual framework for subsequent knowledge
- using specific examples in real contexts that illustrate the concepts and their relationships in such a way that they acquire meaning and feeling
- the combination and the sequence of positive and negative examples that facilitate the conceptual differentiation
- representation of the knowledge in graphical systems, such as the concept maps, that help better understand the relationships among the ideas and the procedures

Progressive differentiation is presenting the most general and inclusive ideas first, followed by increasing detail. Integrative reconciliation is pointing out similarities and differences between old and new learning. Cognitive strategies are skills that may aid the learner in an internal process of attending, selective perceiving, coding for long term storage, retrieval and problem solving.

Concept mapping is a technique for visually representing the structure of information—concepts and the relationships between them—and can therefore aid the student in the process of meaningful learning. Concept mapping is also designed to encourage the mapper to make his or her own connections among knowledge concepts. The more meaningful connections a person can show in the map, the better s/he will understand the material. The process of mapping a map and the final product are dependent on prior knowledge, context, and constructed understanding.

In constructivism, active and meaningful learning is encouraged as an educational philosophy. Learning is a structuring process where knowledge is derived from experiences. Ausubel argued that learning new materials depends greatly on the existing cognitive structure or what the person already knows. New information will be more easily learned if it is explained and also related to relevant ideas in the student's cognitive structure. Meaningful learning occurs when new information is linked to prior information in the learner's own cognitive structure. New information is more meaningful if it is related to existing knowledge.

The basis for this active learning role can best be described in Ausubel's (1963) theory of cognitive learning. Ausubel's principles of non-arbitrary assimilation of knowledge through concept differentiation and concept integration have become the fundamental principles for meaningful learning theory (Wandersee, 1990). Meaningful learning theory is based on these principles:

- 1) knowledge is stored hierarchically in idiosyncratic cognitive structures;

- 2) prior knowledge influences new learning, although misconceptions are acquired early and are resistant to change;
- 3) humans construct new concepts and propositions through meaningful learning;
- 4) meaningful learning is at one end of a learning continuum with rote learning at the other

### **Component Display Theory**

*Component Display Theory (CDT) classifies learning along two dimensions: content (facts, concepts, procedures, and principles) and performance (remembering, using, and generalities). The theory specifies four primary presentation forms: rules (expository presentation of a generality), examples (expository presentation of instances), recall (inquisitory generality) and practice (inquisitory instance). Secondary presentation forms include: prerequisites, objectives, helps, mnemonics, and feedback. Merrill (1983) explains the assumptions about cognition that underly CDT. While acknowledging a number of different types of memory, Merrill claims that associative and algorithmic memory structures are directly related to the performance components of Remember and Use/Find respectively. Associative memory is a hierarchical network structure; algorithmic memory consists of schema or rules. The distinction between Use and Find performances in algorithmic memory is the use of existing schema to process input versus creating a new schema through reorganization of existing rules.*

Component Display Theory is concerned with teaching individual concepts or principles, classifies objectives on two dimensions, and formats instruction to provide learner control. Component Display Theory is composed of three parts (Merrill, 1983):

- A performance/content matrix that includes the desired level of student performance (Remember Instance, Remember Generality, Use, and Find) and the type of content (Fact, Concept, Procedure, and Principle)
- Four primary presentation forms: Expository (Rule, Example) and Inquisitory (Recall, Practice)
- A set of prescriptions relating the level of performance and type of content to the presentation forms

Instruction will be more effective if all three primary performance forms—remember, use, and find—are present for the different types of content or information types. Primary forms can be presented by either an explanatory or inquisitory learning strategy. The sequence of primary forms is not critical provided they are all present. A concept map can be used to provide examples of the concepts as the learner elaborates on that particular concept.

### **Principles of CDT**

1. Instruction will be more effective if all three primary performance forms (remember, use, generality) are present.
2. Primary forms can be presented by either an explanatory or inquisitory learning strategy
3. The sequence of primary forms is not critical provided they are all present.
4. Students should be given control over the number of instances or practice items they receive.

Using concept mapping provides a form of both remember and use. Students are asked to apply what they are learning as they draw the map. The generality is applied in the testing process. They are given control over their instances as they create their individual maps. Knowledge objects can be linked via component relationships: an entity can be a part of another entity, an activity can be a step of another activity, or a process can be an event of another process. The learner acquires knowledge of discriminating properties and is able to sort instances with respect to these discriminating properties. CDT identifies strategy prescriptions for different kinds of learning outcomes. Components of instruction provides a way to more precisely analyze subject matter content and more precisely design instructional strategies to present this material. A significant aspect of the CDT framework is learner control. This idea enables

learners to select their own instructional strategies in terms of content and presentation components. In this sense, instruction designed according to CDT provides a high degree of individualization since students can adapt learning to meet their own preferences and styles.

Two types of knowledge are part of the levels of learning that Merrill describes. Concepts are categories of experience bounded by a definition and given in a name. They are groups or classes of things that have something in common. Concepts are arbitrary groupings that are invented by people. This is displayed by key terms, items, processes, and categorizing items. An important consideration for learning concept classification is prior knowledge. Robert Gagné (1985) has shown that the skill of applying a concept always has some "prerequisite" skills, skills that must be mastered before it is possible to learn any given classification skill. A principle is a relationship among factors. It is composed of two or more concepts having an ordered relationship to each other (Gagne, 1971). Students display this knowledge by applying the principle. Some examples are: control, predict, infer cause, explain, troubleshoot, vary the task based on new conditions. There are two phases to learning a principle at the application level. The learner needs to comprehend the principle. This is referred to as the acquisition phase. After it is acquired, the learner needs to learn to generalize it to new situations, which is called the application phase.

The instructional sequence to be used is based upon performance levels designed by Merrill. His model suggests that the instructional sequence should include application and examples of each order of learning: remember, use and find. This involves establishing an instructional strategy for each phase. I will add another tool, feedback, to the sequence to improve learning.

Order	Instructional sequence
1. remember	Provide the learner with examples that lead to an expectation of successful accomplishment of the skill
2. use	Give learners the responsibility to practice and use the new skill in a supportive learning environment
3. find	New examples will be added to the concept maps
4. feedback	Provide feedback through expert maps to learners on how to improve their concept maps based on instruction on concepts and principles

## This Study

In this study students were asked to create concept mapping and some were given feedback and instruction to assist in their knowledge integration. Effects of different treatments were established with the students to compare the differences with feedback and extra training on knowledge application. After reviewing the literature and issues raised, the researcher has concluded that the use of concept mapping can assist students in separating information and organization of it for recall. Concept mapping does assist in learning and developing skills for meaningful learning. However, does learning concept mapping with instruction on concepts and principles with feedback result in more learning for field dependent learners? Does a field independent learner do better without feedback on concept mapping and instruction on concepts and principles since they tend to favor less structure? The purpose of this study is to determine if more learning takes place when using concept mapping with instruction on concepts and principles, with or without feedback. In addition, the purpose of the study is to determine if field dependent learners tend to do better with structure, framed by instruction on concepts and principles, than field independent learners.

## Summary

Concept mapping is tool that can be used for facilitating learning and assessing meaningful learning. It helps in gaining better and more comprehensive understanding of learning information. This study will attempt to determine if using concept maps will have a significant effect on both concept-type

and principle-type learning. Concept maps serve to clarify links between new and old knowledge giving an opportunity for the learner to externalize the links through test taking. In conclusion, this study will look at what can be done to help students create more effective concept maps using treatments such as instruction on concept mapping and instruction on concepts and principles, with or without feedback, to assist them in better learning techniques.

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# VIRTUAL RESOURCES CENTERS AND THEIR ROLE IN SMALL RURAL SCHOOLS

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## Abstract

Virtual resources centers have been considered a pedagogical tool since the increasing development of electronic means allowed the storage of huge amounts of information and their easy retrieval. Bearing in mind the need for enhancing the appearance of those centers, a discipline of "Management of Resources Centers" was included in a specialized diploma course run at the University of Minho (Portugal) for in-service primary teachers. As a final work for that course, one of us (A. Silva) developed a virtual resources center about Ponte de Lima, which can be easily accessed through the Web site meanwhile created – (<http://www.pontedelima.com>). The center has not merely educational purposes; it also has in mind simple local information useful for tourism or even to get native people, living outside, in touch with their motherland. We describe the way the site was conceived and how its main areas developed; additionally, we present some statements of users, looking for understanding of how they benefited from this tool now at their service.

## Introduction

Since the mid-sixties Portugal has adopted deliberately an educational policy where instructional technology played a significant role. Although at this time the country was ruled by the retrograde dictatorship of the Prime Minister Oliveira Salazar<sup>9</sup>, some signs of openness regarding the education could be noticed, specially concerning the principle of extending the education opportunities.

Portugal is a mountainous country, particularly in the Northern part. There are hundreds of very small villages that stand sparse in the valleys and even in the mountains. At this time, the road network was a very bad one. One of the wiser decisions of Oliveira Salazar was to build small elementary schools (grades 1-4) throughout the country, even in the smallest places. However, while the first four years of schooling were assured, the subsequent years were not, because of the distance to a major center and the extreme poverty of the people living in distant villages, who could not pay additional housing expenses. This was the main reason why most students did not take further courses at the secondary schools.

In 1965 the Government decided to set up the IMAVE (*Instituto de Meios Áudio-Visuais de Ensino* – Institute of Audio-Visual Means for Teaching) and also the *Telescola* (TV school). The *Telescola* started running courses by television to provide students in rural schools two more years (5-6) of schooling, that is to say, extending from four to six the number of school years. The design of *Telescola*, as well as its implementation, was a very good one. Besides the short lessons by television in each school an elementary teacher acted as a monitor, adding some direct teaching to the televised one. As is said in an OECD evaluative report, showing high regard for the Portuguese innovation,

[i]t was altogether unexpected that out of Portugal should have emerged the only well established example in Europe of an integrated learning system, in which television played a central instructional role, covering the full curriculum at 'first-cycle secondary' level, and dealing with tens of thousands of children (OECD, 1977, p. 2).

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<sup>9</sup> Oliveira Salazar was the Prime Minister of Portugal between 1928 and 1968, and ruled the country as a dictator. His successor, Marcelo Caetano (1968-1974), though more moderate, followed the main lines of Salazar's policy and was overthrown by the 25<sup>th</sup> April 1974 Revolution (the Revolution of Carnations).

The *Telescola* certainly was the most evident exploit in instructional technology in Portugal. At its peak tens of thousand students followed yearly its courses. Still today the *Telescola* continues to serve some villages where it is difficult to implement post-elementary schools. Of course Portugal is not today as it was in the 1960's. On the one hand, most small villages lost young population and today there are no children to go to school: some hundreds of primary schools closed. On the other hand, road conditions improved a great deal, and the isolation was broken for a majority of places.

However, it is still difficult to teachers living in small villages to cope with the lack of information and pedagogical materials they need in their everyday life. Teachers recurrently complain about their situation; they want and they deserve to have much more support. Several strategies have been thought of to minimize the poor conditions teachers face in the rural world. Once more technology seems to be the best way to reach such a goal: the Internet may help those teachers, due to the establishment of virtual resources centers.

### **What the Literature Says**

Resource centers are not a novelty: even in the older schools, some educational materials were kept, having in mind their re-utilization by teachers and students to improve the learning process. In the beginning, however, school libraries stood as the main documentation centers. As the audio-visual materials developed, school libraries became true school media centers, keeping together books and other script materials with films, slides, audio and videocassettes.

In 1972, the American Association of School Librarians (AASL) acknowledged the shifting times, deciding to change the name of the AASL journal, *School Libraries*, to *School Media Quarterly*. In a rejoicing article, "A title for the times", Srygley reports us that "[f]or more than twenty years AASL has given strong leadership in defining the school library as a media center, learning resources center, or instructional materials center" (1972, p. 16). Therefore, we can assume that almost thirty years ago the label "resource center" came to the everyday life of schools.

The development of computer technology determined that even the professionals who were reluctant to admit a "library" keeping materials other than books and journals, should change their minds. In 1983, Koskiala summed up the new librarian point of view: "Nonprint is beginning to be given serious consideration in some accredited programs" (1983, p. 309).

The role of media specialists is going to change, and fast: in an examination of the impact of the new information age on education, Considine told us the sincere statement of one administrator, saying that "media specialists were an endangered species, threatened with extinction because they were neither visible nor viable" (1985, p. 182). He added: "For media specialists to survive such a threat, they must change not only their role but the perception many teachers and administrators have of that role" (1985, p. 182). Later, Schiffman (1987) wrote about the "window of opportunity" open to the school library media centers, entering in the online environment, to change public education.

Other authors (e.g., Craver, 1986; Dede, 1985; Ely, Blair, Lichvar, Tyksinski, & Martinez, 1996) drew readers' attention to the effects of the computer explosion, affecting schools and libraries (or media centers). It is notorious that these fifteen years (1985-2000) brought more changes to technology than those that occurred in the past 85 years!

All this means that the conditions to move forward were created. If powerful networking is available, if the storage and retrieval of information becomes easy for anyone, if communicating instantaneously with any part of the world is possible, then, why not have virtual resource centers?

In the 1980s the challenge of new information technologies (NIT) stimulated many contributions that made clear that the future of libraries (or learning centers) depended on the way these institutions were able to deal with those technologies. A new concept of literacy is implicit: besides reading and writing, the knowledge of using the computer is indispensable (Breivik, 1985; Horton, 1983; Hubbard, 1987).

However, it is only in the 1990s that the idea of a "virtual library" (and "virtual resource center") solidifies. Books and journal articles were published throughout the decade clarifying concepts, discussing principles and proposing models (Butler, 1991; Butterworth, 1992; Kurzweil, 1993; Rooks, 1993; Saunders, 1993; Blake, 1994). Most were cautious, announcing the potential of the new format but lowering the expectancy levels. Some of them decided to act as futurologists and we do not know whether they were right or wrong.

## The Situation in Portugal

The first great impact of NIT into the Portuguese school system dates from the mid-eighties, when the Ministry of Education launched a specific program called MINERVA<sup>10</sup>. The objectives were “to develop teaching about computers and learning with computers, with adequate teacher training” (OECD, 1986, p. 22). It had a modest start, considering the budget and the number of schools involved (about 50 secondary schools), but its developments were much more promising. When the project ended, in 1992, 1,172 schools of different levels of education had participated in MINERVA, more than 50,000 teachers had attended in-service training and more than 100,000 students had attended classes or workshops regularly (Ehrmann, Somekh, Withers & Grandbastien, 1994).

In addition, the teachers who were participants as monitors kept from the project a great élan, and most of them completed university degrees in the field and continue, in their schools or elsewhere, to disseminate what they have learned.

The University of Minho had been one of the centers where MINERVA had grown up. Among the teaching staff from the education field but also from the computer science field there existed a strong feeling about the need for developing continuously the pedagogical approaches to NIT use. Therefore, nobody was surprised when, in the late eighties and the beginning of the nineties, the University of Minho set up several post-graduate courses on educational technology, first at master level, then as specialization for elementary teachers.

At this time, elementary teachers were certified after a three year course (corresponding to a bachelor's degree). The post-graduate course consisted of two years of study (thirty five credits). The students who performed well in a final exam, which consisted of the defense of a mini-dissertation, got the degree of “licenciado”, a degree that is popular in Europe but does not exist in the United States.

Those courses were restructured in 1997, and since then the NIT course (now denominated “Information Management and Educational Communication”) offers a discipline of “Management of Resource Centers”. This discipline aims to provide students with the appropriate knowledge and skills to deal with school media centers. As the proponent of the inclusion of the discipline in the curriculum, one of us (C. Freitas) assumed its teaching. His background situation analysis can be synthesized as follows.

In Portugal, elementary schools (the students enrolled in the course were elementary teachers, as it has already been said) are very diverse in their formats: a few are big ones, mainly in important towns, as Lisbon or Oporto, a few are very tiny, as happens in rural regions (some schools have just two or three students!), and most of them are middle sized. By and large, first because of the immigration (mainly in the 1960s and 1970s), then because of the decreasing rate of births in the country, a strong diminution of students in schools became a reality. Because of that situation, new legislation was enforced regarding schools administration. Small schools were invited to reorganize themselves to find partnerships, building groups of schools (“agrupamentos”), that is, schools joined under the same administration in spite their physical distance, which normally is not a substantial one.

Each school has its own equipment and educational materials; most schools have small libraries. The new administration logic challenges the way equipment, and learning resources, have to be used. It is not surprising that the idea to join up the different schools made very clear the need for a new way to make more effective the existing resources: therefore, little by little, some resource centers have been created.

It was decided to introduce in the discipline some discussion about the role the Internet plays in the dissemination of information and the emergence of true virtual resource centers. One of us (A. Silva), even before the course he was taking, was developing a web site about his mother land, the beautiful and historical Ponte de Lima<sup>11</sup>, a town about 30 kilometers distant from Braga. He decided to make some arrangements to transform his site into a virtual resource center to serve educational purposes, although it aims also to reach tourists and other people interested in the historical town.

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<sup>10</sup> MINERVA stands for **M**eios **I**Nfornmáticos no **E**nsino: **R**acionalização, **V**alorização, **A**ctualização (Means of **I**nfornmatics in **E**ducation: **R**ationalization, **V**alorisation, **A**ctualization).

<sup>11</sup> Ponte de Lima means “The River Lima Bridge”. The town still has a very extensive Roman bridge, which is one of the most beautiful in the country.



## The Virtual Resources Center of Ponte de Lima

A. Silva, in his final report (1999), evoked Negroponte. Negroponte several times drew our attention to the effect Internet could play in disseminating information (v.g., 1995, 2000). The development of his idea comes first from the passion for computers and the Internet.

The WWW allows teachers and students to create their own resources and learning environments. However, much more important than the act of creation itself is the potential of such documents to become available to many other people – mainly other teachers and students – but virtually to any human being who uses the Internet. The information generated through the Internet is always accessible, sometimes much more easy to retrieve than in a library, as happens on consulting an encyclopedia or a dictionary on line or downloading pictures and texts.

As it was said, Ponte de Lima is an old town (population: c. 2500). It is the chief-town of the “concelho” (the Portuguese word that stands for county, although the dimensions of most “concelhos” are undersized in comparison to the U.S. counties). The “concelho” has 51 “freguesias” (Portuguese word meaning a small village), with a total of 44,000 inhabitants (Figure 1). Almost all “freguesias” have an elementary school and some of them have two; the number of elementary schools is 61. Ponte de Lima and three other villages possess post-elementary and secondary schools. Ponte de Lima also has agricultural schools, one at the secondary level and other belonging to the polytechnic network (higher education). There is at Ponte de Lima a private extension of a University, the Fernando Pessoa<sup>12</sup> University.

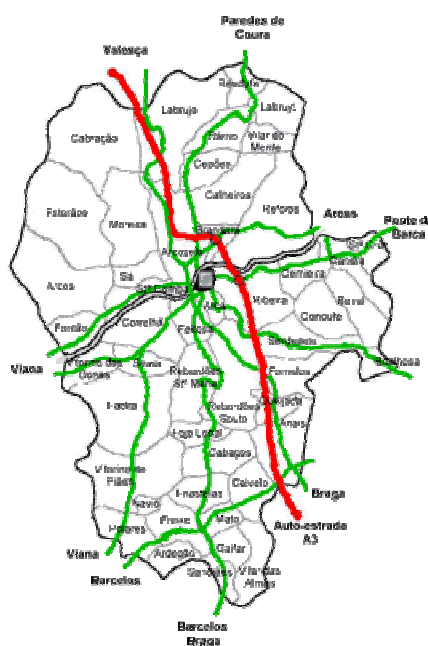


Figure 1 – Map of the “concelho” de Ponte de Lima

The number of students enrolled (1998-1999 data) is approximately 8,000; the number of teachers is 567. The dispersion of elementary schools isolates teachers in their schools. Sometimes, they have difficulty in find the materials they need for their classes. Although each school has a minimum of resources, it is impossible to provide each school with everything it needs. A virtual resource center could help those teachers and their students very much.

Since 1998, following a deliberation from the national government, all Portuguese schools have been equipped with the latest generation of computers and on RDIS line. The first schools to be equipped were the secondary ones; all the elementary schools will have computers by the end of 2001. This does not mean that many elementary schools do not have computers today; many local authorities

<sup>12</sup> Fernando Pessoa was the most representative Portuguese poet from the century XX.

anticipated the government deliberation and supplied some of the schools under their jurisdiction with machines.

This case, the concretization of a virtual resources center to assist those schools made sense. The design of the center, however, also contemplated other kind of concerns A. Silva had in mind: as a local native, he could not forget his fellow-citizens working abroad or people interested in learning more about Ponte de Lima. Consequently the design of the Web site reflected the several publics expected to visit it: teachers, students, emigrants, and tourists.

The visit to the Center shows seven basic themes:

- Access,
- History,
- Villages,
- Folklore,
- Nature,
- Utilities, and
- Pictures.

They are accessed through a navigation bar (Figure 2).



Figure 2 – Navigation bar

Each theme is divided into sub-themes. The theme History, for example, has the following sub-divisions:

- The origins of Ponte de Lima,
- The river “Lethes” myth;
- Characterization of the river;
- The bi-weekly market;
- The “Feiras Novas” (Portuguese words: New markets);
- The “Vaca das Cordas” (Portuguese words: the cow of ropes)<sup>13</sup>;
- Monuments.

Every one of these sub-themes has plentiful documents, written texts, pictures, and songs. Obviously they have links to other themes, according to the logic of the construction.

We can find in this center such varied items as regional recipes, a complete statistical picture of all “freguesias” or the timetable for buses and how to call a cab. The quality of the images is very good, and some images picture dramatic events of the town’s life (Figure 3).

With these documents, teachers can easily pick out those most relevant to their lessons. The site has the address <http://www.pontedelima.com>, or just <http://pontedelima.com>.

However, as some schools did not have Internet access, 200 CD are going to be distributed to all schools of the county, making possible the utilization of the Center by teachers without Internet. Bearing in mind the interest of potential tourists, there are envisaged English and French versions of the site. The problem, for the moment, is finding the appropriate financial support.

As a final requirement for the award of the diploma, the jury who appreciated this work congratulated the author. The Center has been constantly improved since then. It began as dependent on a large site; today it is emancipated, a “dot com” site.

On the other hand, the feedback coming from schools and teachers is very stimulating. One teacher who acted as monitor in a workshop, told us:

The fact that we now have the site [www.pontedelima.com](http://www.pontedelima.com) was a very important event to Ponte de Lima ... it is a very pertinent tool, actually very useful for teachers and students ... it opens new perspectives, because it allows the utilization in the classroom, the teacher having all information needed about Ponte de Lima ... [Personally], during a workshop about “Introduction to the Internet”, I found this site was one of the most used, due to the format,

<sup>13</sup> It is a kind of bull-fight; a cow, not a bull, runs through the crowd secured by some ropes.

structure and variety of effects the Author was able to put in it. It is a good example of quality .



*Figure 3 – A flood – the river Lima reaches the town’s houses.*

A member of the teaching staff of the Fernando Pessoa University sent a short message:

Congratulations on the Virtual Resources Center of Ponte de Lima. Thank you for the significant help you gave us for building our prospectus for foreign students.

From another point of view, A. Silva received several e-mails from abroad: the United States (Massachusetts), Canada, United Kingdom, France, Italy, Brazil, and Spain, among others. The Internet is doing its job, linking people in the world. One of those messages came from Poitiers, France:

I am a French student (from a Portuguese family) ... and I am preparing a comparative study of Portuguese traditional tales and traditional tales from the region where I live, Poitou - Charentes ... Would you tell me if there are anthologies of tales from Ponte de Lima and its environment? ...

Therefore, the virtual resource center is working even outside the region where it was created.

## **Conclusion**

It seems clear that virtual resource centers have a place in our school system, even though “real” resource centers exist. Consulting encyclopedias, dictionaries and databases around the world, visiting museums and exploring endless opportunities is something that can do much more for children than simple books and traditional lessons.

This experience, which we are trying to monitor better next year, when there will be computers in all classrooms, challenges teachers and students: we think that the time has come to jump from the timid use of new technologies as auxiliary of the teaching-learning process to the creation of stimulating, imaginative and supportive technological environments for both teachers and learners. Virtual resource centers could be one of the tools to work out such a challenge.

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# RESEARCH CONSTRUCTS IN DISTANCE EDUCATION: INTERACTION ONLINE

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Interaction has been given number of meanings in the context of distance learning. Computer based training, which may require nothing more than clicking on a button, has been called interactive, as has instructional video and systems that allow voting or polling. It clarifies matters if the word interaction were taken to only refer to situations where a human response referred to a previous human response (Mason, ). This is consistent with Daniel and Marquis' (1983) definition of interaction: "The student is in two-way contact with another person(s) in such a way as to elicit from them reactions and responses which are specific to their own reactions and responses" (p. 32), and Simpson and Galbo's (1986) definition:

Behavior in which individuals and groups act upon each other. The essential characteristic is reciprocity in actions and responses in an infinite variety of relationships: verbal and nonverbal. . Interaction is seen as a continually emerging process, as communication in its most inclusive sense. (p. 38)

Main and Riise (1995) conducted research to design a taxonomy of interaction that took into account dimensions such as amount, timeliness, method, and quality of interaction. Mason contended that interaction increases motivation, speed of assimilation of information, and length of retention of subject matter (Mason, ). When students expressed what they had learned from a personal context and had offered differing points of view, critical thinking skills were developed as learning became deeper.

It has been widely held that interaction is critical to learning and an essential part of the academic process (American Distance Education Consortium, 1999; Berge, 1996; Hassenplug & Harnish, 1998; Kearsley, 1990; Parker, 1999; Phipps & Merisotis, 2000; Shale & Garrison, 1990b). Summers (1991) reasoned that without interaction teaching was reduced to "passing on knowledge as if it were dogmatic truth" (p. 14). This transferal model of learning eliminated any evaluation of the information transferred (Shale & Garrison, 1990a). Parker (1999) proposed that it is not sufficient for instruction to be transmitted linearly from instructor to student without interaction. "Today's distance education courses must authorize students to question their ideas and beliefs, thereby, encouraging provocative and interactive construction of personal knowledge" (p. 13). Peters (1999) concurred by stating, "If we take distance education seriously and understand it to be something more than the mere distribution of reading materials, we must provide sufficient opportunities for dialogues" (p. 13). Noble (1999) emphasized that along with a low student-teacher ratio, the one unquestionable mark of quality education is that there be significant interaction between two parties. Remmers (1995) maintained that without interaction there can be no education. The concept of "no interaction, no education" was used as an online global debate topic using a listserv at the University of Alberta, designed in New Mexico to be used as a pre-conference for the 1995 International Council on Distance Education in Birmingham England, summarized at George Washington University and Penn State demonstrating the potential of world-wide distance learning. This project produced an interaction analysis model for examining social construction of knowledge in computer conferences.

Years before CMC, Dewey (1938) made an eloquent case for the importance of interaction in education:

There is, I think, no point in the philosophy of progressive education which is sounder than its emphasis on the importance of the participation of the learner in the formation of the purposes which direct his activities in the learning process, just as there is no defect in traditional education greater than the failure to secure the active co-operation of the pupil in construction of the purposes involved in his studying. (p. 67)

Moore (1989) defined three types of interaction found in distance learning: learner-content interaction, learner-instructor interaction, and learner-learner interaction. Moore considered learner-content interaction to be the defining characteristic of education because without content there is no education. This basic form of interaction can be one way. A student can interact with a book by reading it or with a videotape by watching it. Currently, learner-content interaction can be seen in computer-assisted instructional programs (CAI) where a student interacts with the contents of an instructional CD-ROM or program, which requires no intervention from an instructor.

Moore (1989) considered learner-instructor interaction to be highly desirable. The instructor motivates and stimulates the learner to enhance student interest and desire to learn. The instructor

organizes information that is then presented or demonstrated to the students. The teacher monitors and evaluates the students' mastery of the instruction, providing feedback and assistance. Depending upon the method of delivery, the student interacts with the teacher either with a great degree of frequency such as is possible in two-way video or computer-conferencing, or with a low degree of frequency in the context of a text-based correspondence course. This form of instruction is an individual dialogue between the student and the instructor without the benefit of a class of peers. Taking part in this form of instruction requires a great deal of autonomy on the part of the learner.

Learner-learner interaction takes place between learners either with or without the benefit of an instructor. Moore (1989) proposed that this form of interaction could be used to teach interaction itself but noted that the uses for it would vary depending on the situation, ages, experiences, and levels of autonomy of the learners. Moore contended that learner-learner interaction would challenge future thinking and practice.

Hillman, Willis, and Gunawardena (1994) proposed a fourth type of distance learning interaction: learner-interface. This type took the specific technologies used for distance learning into account adding another dimension. They proposed that the presence of interaction was a basic need for learning to occur and reinforced the importance of learner-learner interaction when they stated, "Regardless of content, however, instructors should take care to involve the learner in actively using the technology to communicate with other learners" (p. 38).

In the years since the four types of distance learning interactions were noted, research has been conducted exploring these modes of interaction. Powers and Mitchell (1997) in a study of an online course observed that students were able to develop rapport and provide support for each other. The instructor-learner relationship changed to reflect the instructor becoming less of a dispenser of knowledge as a community of learners developed. Similarly, Anderson and Garrison (1998) noted a shift in the balance of power when interactive online components were employed, and that a "learning community realized through learner-learner interaction need not, nor should not be absent from the distance education experience" (pp. 102-103).

Harasim and Yung (1993) in discussing a survey of 176 teachers and learners on the Internet reported differences found in CMC when compared with face-to-face instruction. They discovered that when online learner-learner group interactions greatly increased the ensuing discussions became more detailed and deeper. It was additionally found that personal communications between and among learners increased. Bruner (1971) added that much learning takes place in a social context through a mutual construction of understanding. Ahern (1995) in studying computer conferences observed that learner-learner interaction enhanced learning but also created "an important social environment wherein students engage their peers with talk that informs, explains, persuades, or even entertains. By providing the opportunity for authentic peer interaction, each student will develop an awareness of authorship" (p. 134). During a year-long faculty seminar on distance learning held at the University of Illinois, it was concluded that "an online course taught well creates a great deal of interaction between the professor and his or her students. There must be a great deal of interaction between the students themselves, especially in wholly online courses for placebound students" (University of Illinois Faculty Seminar, 1999, p. 31). However, Johnson, Aragon, Shalik, and Palma Rivas (1999) argued against including interaction in online courses. They proposed that online communication lacked a strong social dimension. The results of their study of student satisfaction in online and face-to-face courses warned that, "until the technologies for online instruction better simulate real time interaction, program developers need to avoid courses that require frequent socialization between the students and the instructor" (p. 21).

Interaction just doesn't happen. According to Kearsley (1990) extensive research insisted that "interactivity must be planned or it is unlikely to occur (or be meaningful). The idea that interaction must be explicitly designed in distance education seems a difficult concept for many instructors to accept or understand" (p. 8). Anderson and Garrison (1995) concluded,

Merely acquiring and using the technology, without regard to the development of opportunities for regular and sustained interaction between and among users and learners, provided no guarantee that a critical community of learners would result. If critical thinking is a desired learning outcome, then learning activities that capitalize on the interactive potential of the medium must be planned and developed. (p. 42)

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## **PROBLEM-SOLVING IN A CASE-BASED COURSE: STRATEGIES FOR FACILITATING COACHED EXPERTISE**

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*The authors gratefully acknowledge the support provided by grant # 2-30906 from the  
Northeastern Illinois University Committee on Organized Research*

This paper proposes the use of specific coaching strategies to facilitate students' use of expert-like problem-solving strategies while analyzing and solving instructional design case studies. Findings from an exploratory study, designed to examine changes in students' problem-solving skills as they analyzed case studies, suggested that students could show expert characteristics at times, under some circumstances, but did not perform like experts on a regular basis. Thirty-seven students at two midwestern universities analyzed six to ten case studies as part of their course assignments. Both quantitative and qualitative data were collected; students' written case analyses (initial conceptualizations and recommended solutions) served as the primary data source. Comparisons were made both within- and across-students, as well as across time, to examine patterns and changes in students' problem-solving approaches. Findings suggested that primary influences on the incidence of expert performance seemed more external than internal and might be more aptly characterized as "coached expertise." Specific suggestions are included for coaching the development of students' problem-solving skills within a case-based course.

Professional educators face a daunting challenge—preparing students to solve the kind of complex, ambiguous problems that they will encounter as practicing professionals. Unfortunately, we aren't always successful in meeting this challenge. For example, in a study by Dahlgren and Pramling (1985), physicians noted the need to reorganize what they learned in medical school from a focus on content areas to a focus on common clinical problems. In addition, engineers and business administrators noted that the theories they learned in school were often too simplistic to help in solving real-life problems. Julian, Larsen, and Kinzie (1999) lamented that "novice (instructional) designers frequently enter the workforce with an understanding of the ID process but without the knowledge base that can help them solve instructional design problems and develop solutions" (p. 2).

Increasingly, professional educators have turned to the use of cases in an effort to help students learn to approach problem situations in the same ways that practicing professionals do. Case-based instruction presents students with a re-creation of a complex situation (a case) and asks them to analyze and solve the problems through reflection and discussion (Allen, Otto, & Hoffman, in press). In case-based instruction the learning focus shifts from the explicit knowledge and skills that form the traditional academic curriculum to the development of active knowledge—what Whitehead called "wisdom" (1929). Active knowledge goes beyond simply recalling information to the ability to use that information to select relevant issues and solve identified problems. For example, students in law school will read a case study and participate in a dialogue designed to elicit the key issues and legal principles in the case. More than simply recalling information, the students are asked to analyze the situation as a practicing lawyer would (Williams, 1992). Similar methods have been used in both business and medical education for nearly 100 years (Albanese & Mitchell, 1993; Christensen, 1987).

Case-based instruction offers a number of advantages for professional education. Cases are thought to be more effective than didactic teaching methods because they (1) more accurately represent the complexity and ambiguity of real-life problems, (2) provide a framework for making explicit the problem-solving processes of both novice (student) and expert (instructor), and (3) provide a means for helping students develop the kind of problem-solving strategies that practicing professionals use. More specifically, case-based instruction can help students learn to:

- Focus on the big picture. Expert problem-solvers typically represent a problem in terms of an appropriate underlying principle while novices tend to represent the problem in terms of surface features (Bruer, 1993). In case-based instruction, knowledge is embedded within complex and ill-

structured problems. As a result, students have an opportunity to practice “spotting” the underlying issues and principles in authentic, relevant problems.

- Work forward from what they know. Experts often build on what they know, generating hypotheses and looking for information to test those hypotheses (Johnson, 1988). In contrast, novices tend to focus on what they don’t know, looking for information to fill in the gaps. A case study, by necessity, presents an abbreviated view of a problem situation. Students are forced to do the best they can with the information that is available. Thus, they learn to frame problems in ways that will move them forward toward a solution.

- Simultaneously consider multiple factors. Experts are likely to consider the web of relationships and interactions that exist in the problem situation, while novices generally consider one factor at a time (Perez & Emery, 1995). Cases allow students to experience the “complex and dynamic forces” (Rowland, 1992) that operate within the kind of complex problems that professionals commonly encounter. Although individual students may initially focus on a single factor when analyzing a case, case discussions tend to bring all of these factors to the table. This, then, facilitates consideration of all factors in an interdependent manner.

- Generate tentative solutions. Both experts and novices generate solution ideas early in the problem-solving process. However, experts are more likely to modify or eliminate those solutions as additional information becomes available (LeMaistre, 1998). Case studies tend to involve more than one key player, each representing a unique perspective. With practice, students can begin to understand that each player has a legitimate voice. Students are encouraged to modify their initial solutions as information accumulates and different perspectives are heard, including the student’s own perspective.

- Consider potential consequences and implications. Experts think through their recommendations more thoroughly than novices, considering how those recommendations might be implemented and what implications they might have (Rowland, 1992). As a part of the case discussion, students are asked to consider the consequences of their recommended solutions and to select the one with the greatest benefits and smallest risk. Students and instructors are encouraged to evaluate each other’s recommendations and to challenge decisions based on their assessment of the consequences for all case players.

Case-based instruction seems to be a natural fit with professional education in the field of instructional design. Like other professions, instructional design is a problem-solving enterprise in which practicing professionals combine creativity with technical skills to solve complex, ambiguous problems. Also like other professions, instructional design educators are looking to bridge the gap between education and practice (Quinn, 1994; Rowland, Parra, & Basnet, 1995) using a variety of methods, including case-based instruction (Ertmer & Quinn, 1999). According to Julian et al. (1999), case studies can help instructional design students (1) draw connections between their emerging knowledge of instructional design and the complex demands of practice, (2) reflect on relevant theory and methods as they explore a greater number of design issues in a broader array of contexts, and (3) broaden their knowledge base as they collaborate with colleagues to identify effective design solutions.

In order to take advantage of the perceived strengths of case-based instruction, the authors developed an instructional design course in which the use of cases comprised the primary instructional method. Our original purpose was research. We planned to examine changes in students’ problem-solving skills during a course in which case-based instruction was used. However, after several different offerings of the course, we found that we had learned more about our use of cases than about changes in students’ problem-solving skills. That is, the changes in our application of case-based instruction appeared more substantial than changes in students’ problem-solving approaches.

Furthermore, as we continued to modify and refine our case discussion strategies, we began to identify techniques that seemed better able than others to facilitate more “expert-like” responses among the students. Thus, we began to consider ways in which we might more purposefully “coach” our students as they developed their problem-solving skills.

The purpose of this paper, then, is to describe our evolving use of case-based instruction within an instructional design course. Recognizing that few guidelines exist for how to coach the development of students’ problem-solving skills using case-based instruction, this paper offers an initial set of recommendations, based on data gathered during three semesters of instruction (five different courses). The first section of the paper describes the context in which case-based instruction was situated, including the courses and the use of cases. The second section offers a set of guidelines for using cases as an instructional method in the education of instructional designers. Specifically, we present guidelines intended to help students use and develop the kind of problem-solving strategies commonly used by experts.

## Context

In the spring of 1998, the first two authors co-taught an advanced instructional design course at a large midwestern university. One faculty member was serving in a visiting position while on sabbatical leave from another institution. The following two spring semesters (1999 and 2000), both instructors taught similarly structured courses at their respective universities. During the spring 2000 semester, the two courses shared a course Web site that allowed students to participate in shared electronic discussions.

Participants (n=37) were enrolled in advanced graduate (n=25), introductory graduate (n=7), or advanced undergraduate courses (n=5) in instructional design. All but one student volunteered to participate in the study. Two undergraduate students were dropped from the study due to incomplete data sets. Course assignments and procedures were the same for participants and non-participants.

Graduate students were enrolled in either an advanced instructional design course within an educational technology program or an introductory course within a human resource development program. Students in the advanced course had taken 0 - 7 previous instructional design courses. Although an introductory instructional design course was listed as a prerequisite, three students were admitted without the introductory course, having gained sufficient foundational knowledge from previous work experiences. Graduate students ranged in age from 24 - 51 years, with an average age of 35 years. Undergraduate students were enrolled in the second instructional design course within a human resource development program. Undergraduate students ranged in age from 21 - 24 years, with an average age of 23 years.

Students in all three courses had a variety of background experiences including retail sales, office work, classroom teaching (junior high, high school, community college, university), nursing, course development, engineering at a local manufacturing plant, and training (formal, informal, one-on-one settings). In general, undergraduate students had less course work and fewer relevant job experiences than the graduates.

## Procedures

Students in each course analyzed six to ten instructional design cases as part of their course assignments. Case studies were drawn from Ertmer and Quinn (1999) and were used in conjunction with other activities (guest speakers, student presentations, project assignments, required readings) throughout the semester. There were no assigned textbooks in the advanced graduate course, although additional readings were frequently recommended or required. The introductory graduate course included an instructional design book by Smith & Ragan (1999) and the undergraduate course used a text by Kemp, Morrison, and Ross (1996).

Students in each course also completed: (1) an open-ended questionnaire describing previous experiences with instructional design and with cases, and (2) a self-assessment survey indicating levels of competency from 1 (weak) to 5 (strong) on sixteen instructional design skills. The self-assessment survey was based on the sixteen instructional design competencies outlined by the International Board of Standards for Training, Performance, and Instruction (IBSTPI, 1984). Students rated their current level of knowledge and skill on items such as: assess the relevant characteristics of learners/trainees (#3), develop performance measures (#7), evaluate instruction/training (#11), and promote the use of instructional design (#16). At the end of the semester, the self-assessment surveys were readministered to all participants.

Students participated in case discussions both in class and on-line. On-line discussions were facilitated via a listserv (spring 1999) or a Web-based bulletin board (spring 2000) and typically preceded the in-class discussions. While the listserv discussions extended dialog among the advanced ID students only, the Web-board discussions included students enrolled in both introductory and advanced courses at the two universities. Various techniques were used to initiate and facilitate the discussions including debate, role-play, and structured discussion. Regardless of technique, each discussion revolved around one or two basic tasks: (1) analyzing the problems and issues in the case and (2) recommending solutions for identified problems and issues.

Qualitative analysis methods were used to examine changes in students' case responses. Responses initially were coded using the five expert problem-solving characteristics (see pages 4-5), but modified to fit emerging themes and patterns. For example, initial codes were used to characterize students' conceptualizations of the case (reporting vs. interpreting), searches for information (absent vs. present information), attention to the relationship among factors (laundry list vs. coherent plan), levels of commitment to solutions (dictatorial vs. advisory), and consideration of the implications of recommendations (narrow focus vs. broad focus).

These codes were refined throughout data analysis and eventually combined into analysis and solution categories (see Appendix A for more detailed descriptions). Recognizing that problem-finding and problem-solving are two related, but different, skills, we examined students' analysis and solution approaches separately. We examined students' analysis approaches by looking at their conceptualizations of the issues, searches for information, and attention to the relationships among issues. We examined students' solution approaches by looking at their attention to the relationships among solutions, levels of commitment to proposed solutions, and consideration of the impact/implications of proposed solutions.

We assigned an independent rating to each student's analysis and solution response. If most of the components of a response were novice-like, the response was rated as "weak." If the response included a fairly equal number of novice and expert-like characteristics, it was rated as "mixed." Finally, if most of the components of the response were expert-like, the response was rated as "strong." This allowed us to 1) compare, within-students, analysis and solution approaches, 2) identify patterns of responses, across-students, that were specific to each case study, and 3) to identify patterns that developed or changed across-time.

## Results

A two-tailed paired t-test ( $df = 36$ ) indicated a significant increase in students' ratings of perceived competency for instructional design skills ( $t = 8.30$ ;  $p < .0001$ ) from the beginning to the end of the semester. Even though all 16 skills were not specifically addressed in the case studies used in the courses, students judged that their competencies had increased across skills (pre-test mean = 3.44,  $SD = .36$ ; post-test mean = 4.15,  $SD = .21$ ). However, this increase in perceived competency was not completely supported by corresponding changes in students' approaches to analyzing cases and recommending solutions. In general, students showed both strong and weak responses throughout the semester. In fact, sometimes students demonstrated a stronger response on an earlier case and weaker response on a later case. For example, when students' attention was directed to the potential implications of a solution, students were able to consider the effects of their recommendations, but they did not always do so on their own. As another example, when students were specifically asked to classify one or several issues in a case, their conceptualizations tended to take on a "big picture" approach. In contrast, if asked to simply describe the issues, students tended to respond with more surface-level reporting.

As we began to consider potential reasons for the uneven development and/or demonstration of students' problem-solving skills, our research focus shifted from an emphasis on what students could or could not do, to what we, as the instructors, did or did not do in our role as coaches. In an attempt to explain our "uneven" results, we reexamined our on-line case discussions to identify if, and how, specific coaching strategies may (or may not) have supported students' performances relative to each of the five characteristics of expert problem-solving.

In the section that follows we describe the specific coaching strategies we used to initiate the on-line case discussions during spring, 2000. Although we recognize that coaching can, and does, occur throughout a case debriefing, our discussion here focuses primarily on the case set-up as a critical starting point. Specifically, we examined the extent to which two expert problem-solving characteristics (conceptualizing the issues in the case and considering the impact of recommended solutions) were facilitated by the use of specific coaching strategies. Given the preliminary nature of these analyses, we judged that these two characteristics offered a useful starting point. First of all, these categories were fairly well defined and, thus, made identification and classification of students' responses more reliable. In addition, the two categories comprised both an analysis and a solution type, which we still considered to be relatively distinct aspects of the problem-solving process. In the next section, we describe students' responses to five different case set-ups: (1) structured discussion, (2) debate, (3) reflective practitioner, (4) role play, and (5) discussion chain. Each technique is considered in turn. (Note: Throughout the following discussion, participants in the ID courses are referred to as "students", whereas those who are receiving instruction within the case narratives are referred to as "learners.")

### Structured Discussion

We used a structured discussion to initiate the on-line discussion for the Frank and Semra case. In this case, two U.S.-based instructional designers are faced with the challenge of developing a new curriculum to teach instructional design to trainers who work for the government of a southeastern Asian country. To begin, the instructors provided a one-sentence summary of the case, followed by three specific questions: (1) what do you think the learners' expectations of the new curriculum will be, (2) what kinds of adjustments do you think the learners will have to make, and (3) how might you facilitate these adjustments? Students were not asked, specifically, to discuss either the underlying issues in the case or the impact of their solutions.

Conceptualization of the case issues. As the first on-line discussion of the semester, this discussion starter seemed to lead to fairly structured responses. Almost every student (16 out of 18) answered each of the three questions, one by one. Perhaps because this set of questions seemed so structured, most of the students (10 out of 16) started by reporting or summarizing the facts in the case. However, even though students' primary focus seemed to be on reporting, 12 students included an interpretation of the case events, either separately or in conjunction with fact reporting. ["The learners need to see a need for change before they buy into a new system of design."] ["This is similar to a change initiative."]

Interestingly, our efforts to help students broaden their initial conceptualizations met with little success. Questions we asked during the discussion to explore the identified issues ["What is it about the culture issue that Frank and Semra should adjust to?"] did not generate any direct responses from the students. However, when another student asked whether the case provided sufficient reason to believe that a change should be made in the training methods being used (a common recommendation), other students added new interpretations of the issue ["Who is the client here? Who has the right to decide what is or isn't appropriate?"]. This difference in students' responses to instructors and peers may have been related to the timing of the case. As the first case, students may have felt some discomfort with this type of on-line environment or with responding to the instructors as participants in the discussion.

Students' consideration of the impact of recommendations. The three questions that opened the discussion asked students to make recommendations but did not ask them to explain the impact or implications of those recommendations. Additionally, the instructors asked few follow-up questions during the discussion and those that were asked generally focused on recommendations rather than implications ["Any thoughts about what Frank and Semra might do to make sure that it goes well with these trainers?"]. In retrospect, there were opportunities during the discussion to ask the students to explore implications (perhaps using questions such as "What effect might that have on the current trainers?") but, unfortunately, we failed to take advantage of these opportunities.

Predictably, students provided recommendations, often stated in specific terms ["I should convince them that the system approach is effective."] ["I will look for new or young trainers."]. However, there was little consideration of the implications of those recommendations. When students did consider implications, they were typically limited to a narrow focus on how a recommendation would solve the identified problem ["Once the interactive atmosphere is established, the losing face problem will not exist anymore."]. Little apparent thought was given to the broader impact of a recommendation, such as how it might affect other participants within the case or fit with other recommendations.

#### Debate

For the second case we facilitated an on-line debate. The Denny Clifford case is about a design consultant, with a traditional instructional systems background, who is hired by a science educator to create constructivist learning materials. As part of the set-up for this discussion, the instructors provided the following conceptualization: "This case raises some important questions about working with clients who view things quite differently from us." Students were then asked to argue whether or not an instructional designer should accept such an assignment. Students were assigned to one of the two positions and encouraged to engage in some "friendly competition."

Conceptualization of the case issues. In response to this set-up, almost every posting represented a conceptualization of why Denny should or should not take this job. Students were forced to support their positions, which led to a variety of sub-conceptualizations of the issue. Some students argued in terms of "comfort" or "stress" issues; others argued in terms of "risk," "challenge," or "growth possibilities." Because of this set-up, few students felt the need to cite facts from the case. Almost every student interpreted the case from the point of view they were assigned. The debate-style set-up seemed to be an effective way to get students to think beyond the facts of the case to the positive and negative sides of an issue. In addition, by providing a primary issue to chew on, the instructors modeled how to conceptualize issues in a case.

Students' consideration of the impact of recommendations. The debate format appeared somewhat successful in helping students focus on implications, especially among students who argued the "yes" position. Students explored implications from both a present and future perspective. In terms of present implications, some students noted that accepting the assignment would require additional work for both designer and client ["He may need to do a little extra work."] ["She may have to play a larger role in the process . . ."]. Other students included suggestions for increasing the likelihood of success on the assignment ["Perhaps Denny needs to talk to the people using Oakes' methods and find out how they are actually using them."] ["First, he can begin by identifying the aspects that he has in common with Oakes . . ."]. In terms of future implications, some noted that accepting the assignment

would help the designer develop his career ["Working with Oakes ... could open up even more doors for him to design for others and get him more jobs."] ["If he begins to limit his range of content and philosophies as a designer, he will be compromising his career."].

#### Reflective Practitioner

A reflective practitioner set-up was used with the Michelle Nguyen case. Michelle Nguyen is a designer/programmer working for a large medical center. She encounters a number of surprises as she prepares to roll out a new product, carefully designed to reflect the requirements of a front-end analysis completed nine months earlier. In this type of case set-up, students were asked to assume the role of the instructional designer in the case, and, as a reflective practitioner, consider "lessons learned" from the specific experience. Rather than place blame on various stakeholders, students were encouraged to "move beyond" simply describing what happened to explaining at least one thing that would be important to do, or not do, the next time.

Conceptualization of the case issues. A reflective practitioner set-up forced students to prioritize the important lessons learned from the case. This took them beyond facts to their own interpretation of the important issues. For example, some of the lessons learned included 1) the need for continual communication, 2) revisiting steps in the ID process as you go along, and 3) having a backup plan for dealing with problems. The lessons-learned approach seemed to help students conceptualize the primary issues in the case in terms of important design processes and procedures.

Consideration of the impact of recommendations. The students explored the implications of their original "lessons" more in this discussion than in previous discussions. In addition, the specificity of the instructors' follow-up questions seemed to have an effect on the discussion that followed. For example, relatively general questions ["How do you think a focus group might have been helpful in this case?"] resulted in few responses from the students. In contrast, questions that were more specific ["But since a learner analysis had already been done, wouldn't this slow down progress on the project ...?"] resulted in a discussion that involved as many as twelve different responses from the students.

#### Role Play

In two different case discussions, students were assigned roles to play and asked to view the case from that person's perspective. In the Haley Lawrence case, students were assigned a role and asked to "get inside that person's head" and identify the issues and concerns of that one person. Haley Lawrence is a case involving a variety of stakeholders within a client organization. Although Haley is hired to help the organization develop training materials for their sales representatives, she encounters several people in the organization who appear uncertain about her role and who find her presence threatening.

The Andrew Stewart case deals with the complexities and subtleties of integrating the contributions of different groups of stakeholders involved with a large design project. A secondary focus is on planning and completing a formative evaluation for a product that is still being developed. The case ends with the team in "crisis mode" as a deadline looms and the information collected, to-date, is unacceptable. In the Andrew Stewart case, students were assigned a role and asked to consider what they would do differently if they could start over and what they would do now, given the situation as it is.

Students were more active in these two discussions, possibly because they had participated in several previous case discussions, but perhaps also because of the safety of playing a role. Students could express themselves more directly and emphatically because they were presumably expressing the views of someone else (a character in the case). One result is that both discussions included virtual arguments between role players. ["To be honest with you, Mr. Sumida, you're changing the work contract on me." "Ms. Lawrence, you were brought in the picture to solve a problem not to create new ones."] ["It was not me who was trying to create new tasks. Instead I was trying my best to focus my tasks on our original contract."] Students tended to stay in character throughout the discussion, often responding to one another in the first person. ["Why should these be my problems?"] ["Don't put me in a bind."]

Conceptualization of the case issues. Despite an involved and intense on-line discussion, the Haley Lawrence role-play appeared only mildly successful at helping students frame and address design issues in the case. While students may have considered how one individual perceived the issues in the case, they did not work very hard, if at all, to understand each other's issues. Students enjoyed playing personalities, as noted earlier, but did not seem to move outside the personalities to consider broader case issues. However, in the students' defense, they participated in this discussion exactly as they were instructed. Had we encouraged them, sometime during the discussion, to switch hats with another stakeholder, we might have been more successful in moving beyond personalities to issues.

The second role-play set-up was primarily solution-oriented. Although students were assigned roles to play, they were told, right from the beginning, that they all shared responsibility for

the current situation. Thus, students refrained from blaming others, and looked for ways to help salvage the situation. As the role players considered their own responsibilities in causing the situation, conceptualizations emerged ["I should not have involved a group that wasn't as motivated about this project as the others."] ["I think that the major flaw in what happened had to do with communication."] ["I should have been more professional."].

Consideration of the impact of recommendations. Students did consider impact and implications in these discussions. On occasion, this included the practicalities of implementing suggestions that were made. ["You can have the St. Louis team send back the manuals on a weekly basis."] Typically, however, this was limited to a narrow view of how suggestions made by others affected their own roles. ["Why should these be my problems?"] ["If you could show me a little respect . . ."] Students seemed to have difficulty stepping outside of their assigned roles to see the situation more broadly or to acknowledge the perspectives of the other role players.

#### Discussion Chain

For the Sandra Hernandez case, students were asked to structure their discussion in the form of a chain reaction. The Sandra Hernandez case describes how an instructional designer, Jake Spaulding, was asked to help Sandra "fix" problems she was having with her freshman engineering lab. In order to help Sandra, Jake must balance a number of contradictory requirements and work within numerous resource constraints. For this discussion, one of the instructors started by describing what he saw as the most important issue and then proposed a solution. Students then were instructed to either agree or disagree with a posted comment. If they agreed, they had to add something to the comment; if they disagreed they had to pose a counter argument.

Conceptualization of the case issues. This type of set-up provided students with a model of how to conceptualize one issue in the case and then pose a relevant solution. By requiring students to add to each comment that they responded to, we forced them to consider other important issues that had been ignored or potential consequences of proposed solutions that had not been considered. Students looked for nuances in interpretation so that they could enhance or offer an alternative to a comment already posted. ["I don't agree that time is the main issue. I believe the main issue is what will be the best approach to teach the class...I'll consider time as one of many factors that are involved in the main issue."] Thus, conceptualizations were more complex than in previous cases, and evidence was typically provided to support specific conceptualizations. It is important to remember that this discussion occurred late in the semester, which may partially explain the increased complexity of students' responses.

Consideration of the impact of recommendations. The "ground rules" inherent in this type of set-up encouraged the students to think more directly about the implications of posted solutions. They could agree or disagree with a recommendation, but only after giving it some thought – what benefits or limitations did they see. One result was that students seemed to take a relatively broad view of a recommended solution. Sometimes this took the form of adding suggestions about how to implement a solution. For example, one recommendation was to have the lab already set up for the learners. Students added their thoughts about how to make this work. ["I can see this happening with the classes being divided into two sessions."] Sometimes it took the form of pulling in other issues. For example, another recommendation was to conduct the lab activities via computer simulation. Students discussed this solution in terms of cost ["Although this seems like a good solution, it's expensive and time-consuming."] ["If you cost out 80 students per semester, it would not take long to make this program cost-effective."], access ["Are there computers available for all of the students to have access?"], and instructional methods ["From the case, it seems to me that the experiments are a very 'hands on' type of procedure. I think computer simulation is not good enough for this type of experience."]. In order to agree or disagree with another person's comment, students had to carefully consider the many implications of a recommended solution. This, then, led to a fairly sophisticated understanding of the impacts of any single solution.

#### Coaching Guidelines

In general, students in our case-based courses perceived themselves as more competent at the end of the semester than at the beginning. However, the problem-solving strategies they used did not show the same kind of improvement. Students showed both strong and weak responses to cases throughout the semester, suggesting that their problem-solving expertise was not internalized. They could show characteristics of expert problem-solvers at times, under certain circumstances, but did not do so on a regular basis. The primary influences on their analysis and solution responses appeared more external than internal.

One of the external influences on students' responses was the way the case discussion was set up by the instructors. In the previous section, we described the coaching strategies we used to initiate on-line case discussions and the results that followed their use. Specifically, we related these results to

two expert problem-solving strategies: (1) the ability to conceptualize situations in terms of underlying principles rather than surface details, and (2) the ability to consider the impact and implications of recommended solutions in broad, rather than narrow, terms. In this section, we abstract from these results several strategies that instructors can use to guide their own coaching efforts. We have purposely described the strategies in broad terms in order to present strategies that can be applied through various techniques to cases in a variety of content areas. Where possible, we illustrate the strategies with examples from our case-base courses.

### Coaching Students' Conceptualization of Case Issues

Strategy 1: Structure the discussion by giving students an initial role to play or a position to take in the discussion. In our case discussions we used debate, role-play, and reflective practitioner formats, all of which worked reasonably well as a way of implementing this strategy. Besides supporting students' conceptualization of the case issues, several other benefits appeared to result from using this strategy:

Safety. Students can present observations and opinions within the context of the assigned role, and not feel like they are exposing their own views to disagreement, ridicule, or evaluation. For example, during the on-line discussion of the Haley Lawrence case we asked students to play one of five characters in the case and to describe how that person viewed the case situation including his/her issues and motives. Students used a variety of creative approaches to express the thoughts, feelings, and opinions of their assigned character. One student wrote in a stream of consciousness, which enabled other students to read this character's innermost feelings and thoughts about the case. ["I can't believe Sumida didn't tell me about his task force and this list. Great, I see where this is going... When is Califano coming on board again? I can't wait until then, okay schedule an appointment with Katz..."] Another student summarized her response in the form of a memo to another character. A third student set the scene and then began sharing his thoughts on the case by talking to himself ["Sumida was smoking his last cigarette before going to bed, while reviewing a chapter of Covey's Seven Habits of Highly Effective People. He flipped over the open book on the table and he paused into thinking about his last meeting. The meeting scene was in front of his eyes, he started talking to himself and creating his own scenarios about the new project."]. The safety of responding from the perspective of an assigned role appeared to give students permission to respond both boldly and creatively, without fear of being criticized by their peers.

Starting point. The assigned role or position gives students some initial guidance and/or parameters that help them form their initial response. For example, when we began discussing the Denny Clifford case we asked students a single question: "The first question that needs to be addressed is whether it's even possible to design instruction for someone whose philosophy is diametrically opposed to our own – and when we don't really understand that other philosophy." We then asked half of the students to "present reasons why Denny should not try to work with Cynthia" and the remaining students to "present reasons why Denny should be successful working with a client with a different philosophy." The assigned position enabled students to engage in a lively debate as they argued both why Denny should take the job ["My opinion is that Denny Clifford should 'say yes bravely' to taking this job especially because he should remind himself that he is an independent consultant for a reason . . . that he must try to continually learn different philosophies of education so that he is able to innovate more instructional designs"] and why he should not take the job ["My position is that Denny Clifford should just say no to taking this job. He reminds himself that he is an independent consultant for a reason . . . that he can choose the jobs he wants to work on."]. In addition, being assigned a position that one didn't necessarily agree with encouraged students to consider strong arguments from both sides of the issue. This, then, provided them with a more complete view of the situation, allowing them to see that there were advantages and disadvantages to either decision the designer might make.

Multiple perspectives. Assigning different roles within a single discussion helps ensure that the viewpoints of different key players within the case will be voiced. This results in a broader view of the case. Following this, additional questions can be posed to compare and contrast the conceptualizations or interpretations of the case represented by the multiple roles. Returning to the Haley Lawrence case, each student played the role of one of the five characters in the case, which meant that several students were playing the same role during the discussion. Therefore, each character in the case had at least one voice in the discussion. During the discussion, the instructors can also help students move beyond their own role to see the viewpoints of the other characters ["So what exactly do you think is motivating his actions? And how can Lawrence get through to him and everyone else?"]. However, this may need to take the form of explicit directions, as the students in our courses did not seem inclined to do this on their own.



### Strategy 2: Begin the discussion with a structure, but avoid rigid adherence to that structure.

It's important to remember that the instructor has two basic tasks in the case discussion: (1) setting up the discussion to create a dialog among the students and (2) facilitating the discussion to keep the dialog going. A flexible discussion structure helps with both of these tasks.

Creating a dialog The case set-up helps to "prime the pump" by providing students with an initial shared framework for thinking about the case and expressing their thoughts. For example, in the chain-reaction approach used for the Sandra Hernandez case we started the chain by (1) making a statement, (2) asking an open-ended question, and (3) presenting a set of ground rules for the subsequent discussion. Specifically, one instructor began the chain: 1) "I think the biggest problem here is the students' backgrounds. They just aren't ready for this course. To solve this problem, I think Jake should find a way to simplify the content of the course so that it is more in line with the academic background of the students coming into the course. 2) What do you think? 3) If you agree, you must add to the posted comment in some way. If you disagree, you must offer an alternative of some kind." By including both guidelines and an example of how to follow the guidelines, we jump-started the discussion and made it easy for others to jump in.

Maintaining the dialog Once the discussion starts and the ideas are flowing, the initial structure has served its purpose. In fact, students sometimes find it more constraining than facilitating. The instructor's tasks at this point are to help the students find the connections among the points being made and relate their discussion to the "big picture" issues in the case. For example, during the discussion of the Denny Clifford case, one student suggested an analogy to support her point. There were different interpretations of the analogy, which lead to a digression in the discussion. One of the instructors maintained and refocused the dialog by looking beyond the analogy and posting a question. ["Christie's comment brings up ... two good questions: (1) Do you have to understand a philosophy in order to design instruction to teach that philosophy; (2) Do you have to subscribe to the philosophy in order to design instruction to teach that philosophy?]. In maintaining the flow of the discussion, it's important to remember that we want students to do more than just 'talk'; our primary goal is to maintain a focused discussion that continues to address the issues in the case.

### Coaching Students' Consideration of Implications of Solutions

Strategy 1: Ask specific questions and limit the number that you ask. During the initial set-up, it is possible to ask students to identify a problem, suggest a solution, and describe the possible impact of that solution. However, this may be too much for the initial set-up. It may be easier and better to explore these separately as the discussion progresses. When the initial set-up is too restrictive students do not have room to express their views and may feel that they are providing "answers" rather than discussing ideas. Once the discussion is going, however, students can more readily respond to specific questions about the impact of their recommendations on case stakeholders. Benefits of this strategy include:

Prevents students from being overwhelmed. A multi-part initial question may overwhelm students, especially if it appears to require specific answers. For example, we began the discussion of the Frank and Semra case with three specific questions, described above. The students were slow to respond to these questions, reporting that they felt overwhelmed by the number of questions and that they were concerned about posting "correct answers." In contrast, we began the discussion of the Andrew Stewart case by asking the students to discuss two questions from their character's perspective: (1) If you had to do it over again, what would you do differently? (2) Now that you're in the pickle you are in, what will you do next? This technique enabled students to jump into the discussion without feeling like they were overwhelmed or had to come up with the right answer. A result was that students joined the discussion more quickly and freely ["I obviously should not have tried to involve a group that wasn't as motivated about this project as the other participants..."] ["...If I had to do it over again, I suppose I should have reacted to my gut instinct when I saw the St. Louis team making faces. I'd forgotten how some designers think they know it all as soon as they land a nice paying job right out of school..."]. It is important to pay close attention to the manner in which a case discussion is opened; concern over "correct answers" is likely to stifle participation.

Creates open dialog among students. Asking specific questions encourages students to 1) respond to one another's problem identification, 2) suggest a solution to a problem described by someone else, or 3) describe the impact/implications of a recommendation made by someone else. For example, throughout the Sandra Hernandez case students actively responded to one another's answers using the "chain-reaction" approach and offered alternative perspectives on the impact and implications of the case. Students often responded directly to a person and posed additional questions ["Your consideration about the limited budget available is nice, but how could students 'collect data' without

conducting real experiments or computer simulations?”] [“I still disagree. How will the students’ conduct the experiments if the equipment isn’t set up? Will the students still set it up? If they do then the diagrams may use even more valuable time when the students study them.”]. Having permission to disagree with each other’s interpretations allowed for a rapid exchange of comments, each providing a new consideration of possible impacts.

**Strategy 2: Look for opportunities to join the discussion, but participate carefully.** As the discussion progresses, the instructor’s primary responsibility is to maintain the dialog. To do this, it’s important to continually look for opportunities to add questions and comments designed to help students see connections – to other students and to the big ideas that frame the case. At the same time, it’s important to monitor the possible effects that your input may have on students. Students sometimes perceive comments from the instructor as the “answer,” which may impede, rather than support, the dialog. In these situations, it is often better to resist the natural tendency to add your own, more expert views and let the students come to their own understanding of a case and its solution. Of course, this doesn’t mean that instructors should avoid participating in the discussion. It means only that instructors should be constantly aware of the potential effects that their participation may have. Benefits of this strategy include:

**Models expert responses.** When the instructor models expert responses the students get a clearer picture of what is required of them. For example, in response to an ongoing discussion of the Michelle Nguyen case, one instructor wrote: “Playing devil’s advocate, even if Michelle had conducted monthly (or quarterly) meetings with Alex and Susan, she still may not have found out soon enough about the library hours not being sufficient. I mean when is soon enough when you’re creating CBI? And maybe the library hours aren’t the real issue.... So the question I have is – do you think this case primarily illustrates a front-end analysis problem or an implementation problem? Ideas, anyone?” This comment was an example of both considering the implications of a recommendation that had been made (monthly meetings) and looking for the underlying principle (Do you think this case primarily illustrates a front-end analysis problem or an implementation problem?). Also, by prefacing the comment with the warning, “playing devil’s advocate,” the students realize that their previous comments are not being criticized. In this way, students are encouraged to think about the issues in ways they previously hadn’t considered.

**Supports ongoing dialog.** The instructor’s comments and questions can also encourage students to elaborate their thoughts about a point raised in the discussion. Other students can, then, respond to the elaboration, thereby continuing the dialog. For example, during the discussion of the Haley Lawrence case, we commented on one student’s reaction by posing additional questions for students to explore. [“So what exactly do you think is motivating his actions? And how can Lawrence get through to him (and everyone else?)”] When instructors participate carefully, through questions and comments, students’ problem-solving approaches may incorporate more expert-like characteristics, including the consideration of the impact of initial recommendations.

## **Limitations**

We began this work with the idea of identifying patterns in the development of students’ problem-solving skills. What we found, however, was an absence of patterns and, over the course of several semesters, our focus shifted to examining the coaching strategies we were using. In the previous section, we suggested several broad strategies instructors can use to guide their coaching. The strength of these suggestions, however, is limited by several factors, including: (1) our analysis codes and categories may not have been sophisticated enough to find patterns in students’ problem solving skills, and (2) there may have been insufficient time for students’ problem solving skills to develop. Both of these limitations provide opportunities for future research.

One of the unstated goals of this investigation was to develop and apply an analysis framework for examining students’ responses to discipline-related case studies. The framework developed during this research, although greatly refined from its initial stages, must still be considered preliminary. Additional refinements are needed to allow consistent application while analyzing students’ case responses.

The development of problem-solving expertise is known to take place over a long period of time. Trying to capture this development in a semester-long course is difficult, at best. Longitudinal studies are needed to determine if, and how, this process occurs over an extended period of time, and the extent to which instructors can influence that process through the coaching techniques they use during case discussions. Furthermore, it is important to determine the extent to which students who develop strong problem-solving skills within case-based courses actually transfer these skills to their future jobs. Does the experience of solving cases in a college course benefit instructional designers in their future practice? Further research is needed to address these important questions.

## Conclusion

Case-based instruction has been heralded as a powerful means for helping instructional design students bridge the gap between novice and expert practice (Julian et al., 1999). However, case-based instruction does have its risks. Students may like using cases and perceive that they have learned a lot. But this does not necessarily mean that they have gained new or better problem-solving skills that will help them become better instructional designers. Blumenfeld, Soloway, Marx, Krajcik, Guzdial, and Palinscar (1991) suggested that "without adequate attention to ways of supporting students and teachers, learning-by-doing will not be done" (p. 374). Case-based instructors need effective strategies for supporting students during case study analysis. If not used well, cases may merely perpetuate the approaches and strategies that students already use. Clearly, teaching with cases is not an easy task. As noted by McNergney (1999): "Teaching and learning with cases is not for the faint of heart" (p. vi).

Sykes and Byrd (1992) stated that "learning from cases will depend on the interaction among what the case presents, what the reader brings, and what the teacher does with the case" (p. 511). J. Shulman (cited in Lundeberg, Levin, & Harrington, 1999, p. 15) expressed the importance of discussion and facilitation when she noted, "cases, even with commentaries, do not teach themselves." The role of the coach (instructor) is viewed as being critical to the success of the entire process. Yet, there are very few guidelines available for instructors who wish to begin using a case-based approach. With little guidance, instructors can easily fall into the trap of thinking that just because case discussions are interesting and engaging, that students are learning the things they need to learn to become better designers.

Through our ongoing examination of students' responses to the use of cases, we have identified techniques that appear effective in eliciting students' use of effective problem-solving strategies. Although our results are preliminary, this work addresses two important questions about the effective use of cases in instructional design courses including: 1) what to assess as evidence of students' learning in a case-based course and 2) how to achieve specific learning outcomes (e.g., increase in problem-solving skills) through the use of specific coaching strategies. To date, little work has been done to actually measure changes that occur in students' problem-solving skills through participation in a case-based course. Even less work has been done to tie specific coaching strategies to the attainment of those outcomes. This work represents the first step in addressing these important issues. Still, we realize that there is much more to learn. We plan to continue to examine specific coaching strategies that facilitate student problem-solving within case-based instruction. In addition, we plan to continue to hone our analysis skills so that we can more readily examine the effectiveness of different coaching strategies on the development of students' problem-solving skills. Ultimately, by refining our case-coaching strategies, we hope to increase the potential of case-based instruction to facilitate the development of expert problem-solving skills in our instructional design students.

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## Appendix A: Descriptions of Coding Categories

### 1. Conceptualizing the issues (reporting vs. interpreting)

When confronted with a “messy” problem situation, novices are likely to report or summarize the issues, as they are described in the case. The report is often verbatim and appears to take the problem(s) presented in the case at face value with little apparent effort to consider the extent to which the presented problems are at the “heart” of the case. The result is a simple recounting of issues, as others see them, that often remains at a superficial level.

Experts are less likely to take the presented problem at face value. Instead, they will use their own experience to inform their view of the case and to reframe the problem, often using their own words. Experts are more likely to identify the “central” issue in a case or to categorize or prioritize the issues in some way, often including an explanation of the principle underlying the priorities. The result is an interpretation of the case that is often unique and specific to the situation.

### 2. Building on what is known (absent information vs. present information)

When confronted with an ill-defined problem, both novices and experts recognize that they have incomplete information. However, novices tend to focus on what they don't know and to ask questions designed to fill the perceived information gaps. In doing so, they seem to lose sight of what they do know, suggesting that a great deal of additional information is necessary before a solution can be developed. In addition, their approach to information gathering often seems scattered. That is, they suggest additional information without apparent consideration for the specific purpose or value of that additional information.

In contrast, experts more often focus on what they do know. They will make inferences based on available information and consider scenarios that are likely to emerge as more information is obtained. In addition, they tend to take a more focused approach to information gathering. That is, they will look for specific information that will help confirm or refute their interpretations or assess the effectiveness of their proposed solutions.

### 3. Attending to the relationships among factors (laundry list vs. coherent plan)

Both novice and expert problem solvers are likely to consider multiple factors in a case. However, novices often take a “laundry list” approach to both identifying problems and proposing solutions. With problems, this often takes the form of lists of issues (sometimes long lists) that are presented as separate items. There is little apparent consideration for how the issues might be related, perhaps as parts of a larger issue, and little apparent effort to organize the list. With solutions, this often takes the form of a list of suggestions, again presented as separate items with little apparent consideration for the relationships that might exist among the suggestions. In both cases, the result is a piecemeal collection of ideas that lacks apparent coherence or coordination.

In contrast, experts are more likely to have a coherent plan. They may identify multiple issues, but are more likely to make explicit links among those issues. Similarly, they may suggest multiple solutions, but link the suggestions together in a coordinated effort to solve the problem(s).

### 4. Considering solutions in tentative terms (dictatorial vs. advisory)

Both novice and expert problem solvers are solution oriented and often propose solutions early in the problem-solving process. However, they will do this in different ways. Novices often propose solutions in a dictatorial manner (you must ..., you should...). They are likely to take a judgmental position, often criticizing or finding fault with one or more key players in the case. In addition, once proposed, their suggestions are often “carved in stone.” As new information becomes available, novices tend to stand by their original suggestions. Rather than modifying their suggestions, they often find ways to justify them in spite of the new information.

In contrast, experts recognize that the available information is incomplete and that there are multiple ways to address the different issues. As a result, they are likely to take an advisory tone when making suggestions (you might..., perhaps you could...). They are more likely to take an empathic position, explaining possible reasons behind the actions of the key players in the case. And they are more likely to modify or eliminate proposed solutions new information becomes available.

### 5. Considering the impact/implications of proposed solutions (narrow focus vs. broad focus)

Both novices and experts frequently suggest solutions to the problems identified in a case. Novices make suggestions without apparent regard for how those suggestions might be implemented or what effects they might have. That is, novices typically do not include overt consideration of impact and implications in their write-up of a case. When they do consider impact/implications, it is limited to

a narrow focus on resolving the identified problem. This takes the following form: The problem is ... What I would do is ... That would solve the problem by ...

In contrast, experts typically think through their suggestions, explicitly considering how those suggestions might be implemented and/or what effects they might have. In addition, their consideration of impact/implications is broader. It often goes beyond a straight-line focus on problem and its immediate solution to consider other issues that may be important (e.g., cost, time, reactions of key players).

# THE VIRTUAL RETINA: IS GOOD EDUCATIONAL TECHNOLOGY ALWAYS STRATEGIC?

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*Educational technology units must continually monitor their strategic plans to ensure that they are aligned with the realities of their institutions. Strategic dissonance occurs when previously successful strategies are no longer achieving the same positive outcomes. The Virtual Retina project is used here as an example of strategic dissonance for the Academic Technologies Centre (ATL) at the University of Alberta. In addition, a number of methods for analyzing the strategies used by educational technology units are presented. These methods provide a means for units in higher education to conduct the ongoing task of maintaining their strategic plans.*

The Academic Technologies for Learning Centre (ATL) is the campus educational technology unit at the University of Alberta. For over five years, it has effectively facilitated the professional development of instructors and supported the production of educational resources. The educational technology environment is a "high velocity" world with rapidly shifting demands and expectations. This necessitates that units such as ATL continually monitor the effectiveness of their strategic plans to ensure that they are aligned with the realities of the academic environment. During this monitoring process, it is important to be attuned to situations in which previously effective strategies aren't achieving the expected positive outcomes.

ATL's products and services, effective until recently, are no longer achieving the same positive outcomes. This sort of change would be expected in the dynamic field of educational technology,

*...in extremely dynamic industries alignment between a firm's strategic intent and strategic action is not likely to last. Inevitably, strategic actions will begin to lead or lag strategic intent. Such divergences between intent and action cause 'strategic dissonance' in the organization.*

(Burgelman & Grove, 1996, p 8)

Strategic dissonance can be used as a lever for improvement within an organization if it results in a thorough analysis of the organizations external environment and internal capabilities. This sort of analysis is often referred to as a strategic analysis. There are many methods for conducting a strategic analysis that will enable an organization to improve its approaches rather than experience ongoing failure.

The Virtual Retina CD-ROM project is presented here as an example of strategic dissonance, the Achilles heel of many educational technology units. Following this case, a number of methods for analyzing the strategies used by educational technology units are presented. These methods provide a means for units in higher education to conduct the ongoing task of maintaining their strategic plans.

## The Virtual Retina: A high-tech case study

ATL employs twenty staff members whose range of expertise includes instructional design, evaluation, multimedia development, Web authoring, and graphic arts. ATL provides grants for ATL partnerships to instructors as the U of A. The grant includes money intended to support release time for instructors to work in the ATL production studio learning instructional design and technical production skills. ATL also offers a diverse range of workshops related to teaching and technology to the campus.

The Virtual Retina CD-ROM was created through an ATL partnership grant provided to the Department of Ophthalmology at the U of A. The project team consisted of three ophthalmologists, a medical student, an instructional designer, an Authorware developer, and a graphic artist. For the Virtual Retina partnership, the grant was used to employ the medical student to work full time in the ATL production studio for six months. The project lasted from December 1999 to August 2000.

The CD-ROM contains a virtual clinical environment to provide residents with skills and experience related to diagnosis of diabetic retinopathy, a leading cause of blindness in developed countries. As some diabetic pathologies are clinically diagnosed by their 3D appearance, problem-based cases require learners to evaluate 3D digital photographs. Through this application, learners



acquire a thorough understanding that would otherwise take an extended period of time to achieve through traditional clinical observation. The Virtual Retina CD-ROM contains the following features:

**Case-based problem solving:** In the CD-ROM's Clinic, learners practice diagnosing and prescribing treatments for a comprehensive set of pathologies without being dependent on the availability of patients.

**3D digital imagery:** Digital imagery has been used in ophthalmology for some time now, but never in 3D. The observation of the stereographic appearance of several diabetic retinopathic lesions is vital to diagnosing and managing patients. A partnership with Stereoviewer Inc. has enabled the incorporation of this advanced technology.

**Interactive tutorials:** Highly visual tutorials accompanied by decision trees provide vital background knowledge about diabetic retinopathy and illustrate the diagnostic decision making process.

**Library of articles:** Learners can acquire copies of comprehensive literature reviews on pertinent topics in diabetic retinopathy.

**Glossary:** Key terms are defined and hyper linked throughout the application.

The Virtual Retina CD-ROM will be used by approximately five ophthalmology residents a year at the U of A. It will also be available at no cost to Canadian ophthalmology schools of which there are nine English-speaking and two French-speaking programs. The Virtual Retina application is sound pedagogically and has superior production values.

Despite the obvious merits of the Virtual Retina CD-ROM, the project has been the topic of much debate at ATL. One concern is that the project consumed a significant amount of resources, yet will only be used by a handful of medical residents a year. How does an educational technology unit evaluate whether to develop resources that will be used by five ophthalmology residents a year versus resources that might support 400 first year students? Does the Ophthalmology department, through the sponsorship of charitable foundations such as Canadian National Institute for the Blind and the Canadian Diabetes Foundation, better fund a project such as the Virtual Retina?

Secondly, while the ophthalmology instructors were the primary partners for this project, they had little time to devote to contributing content or being involved in the ongoing development effort. Thus, the U of A faculty members did not develop any new skills and understanding related to teaching and technology, which is the intended outcome of the ATL partnership program. The medical student acquired many skills related to multimedia development including multimedia script writing and project management. However, he is not part of the university teaching staff, so ATL's primary function of being a professional development rather than production unit was not realized with this project. This is an excellent example of strategic dissonance...the intent of the ATL partnership was only partially realized despite extensive support and a high-quality product as an outcome. This situation was experienced in other projects at ATL over the course of the past year.

Are CD-ROM projects inherently too costly to be sustained by campus-based technology centres? Or, should more of this high-end type of production be supported? How do organizations such as ATL and other campus educational technology centres formulate the strategies they will use on an ongoing basis? While people are generally aware of how to compose mission and vision statements, the path to a clear set of operational strategies is one full of dead-ends and morasses of detail.

## Using strategic analysis strategies

While ATL's business plan is full of noble goals, a precise set of operational strategies is lost within the exhaustive lists of tasks. Strategic planning involves assessing both the external competitive environment as well as the internal capabilities of an organization to meet the demands of the campus environment. In the following, a sampling of methods will be used to assess the internal resources and competitive capabilities of ATL. These methods include strategic mapping, SWOT analysis, value chain analysis, and competitive strength assessment.

Descriptions of methods for conducting strategic analysis are usually framed for business and industry environment and are fraught with terms such as "rival", "marketplace", and "threats." These terms are not commonly used within academia. However, perhaps they should be. Often campus units, such as ATL, flounder as they apply imprecise planning models. A more "business-like" approach to strategic analysis can yield many valuable insights and is appropriate for the public sector in general and universities in specific (Poister & Streib, 1999; Tischler, Biberman, & Alkhafaji, 1998).

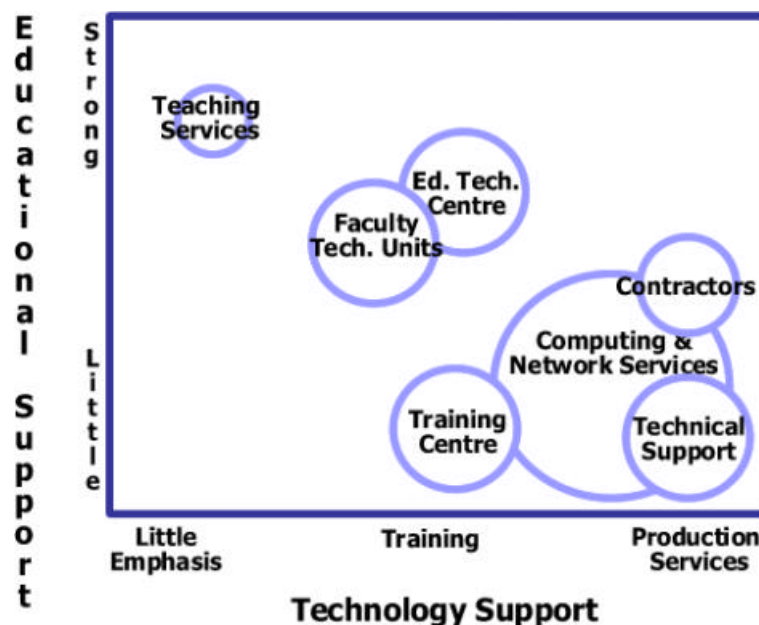
Several questions will be used to structure the discussion. The answers to these questions provide a number of vantage points from which to view ATL's strategies (Thompson-Strickland, 2000). This process is one valuable not only for ATL, but also for other educational technology units coping with the ever shifting dynamics of educational technology implementation on their respective campuses.

### What is the unit's external competitive environment?

ATL is located on a campus that serves approximately 30,000 students. It has a faculty of tenured and part-time teaching staff approaching 3,000. A number of other centres on campus serve this population of instructors. Some provide services that overlap ATL's. To remain viable, ATL must demonstrate that it is filling an important niche on campus. It must continue to differentiate its services in a way that satisfies University Hall's desire to avoid redundancy and support only those organizations adding true value to the university.

Strategic maps are one way to visualize the relationship of an organization to other "competitors." While units situated on campuses are sheltered from the full force of a free market, they are funded by central administration and vie for the limited funds available. In this sense, an educational technology unit's competitive market consists of the centres that support teaching and technology use on campus. A strategic map such as shown in Figure 1 depicts how campus-based units position themselves related to supporting academic staff members at the U of A.

Figure 1: Strategic Map of a Campus Educational Technology Centre



In the above map, technology and educational support have been chosen as the two axes. However, any two variables that distinguish the activities of organizations can be used. A circle roughly proportionate to the size of its operating budget represents each entity.

The map demonstrates a clustering of centres in the lower right quadrant. These centres are largely technology focused with little emphasis on effective teaching. In the map, it is evident that ATL serves an important niche by providing services related to both instruction and the application of technology and is currently favorably located on the map. The proximity of the faculty-based units to ATL illustrates their direct competition with ATL. A number of questions that arise with respect to ATL and campus technology units in general in connection to the strategic map. What services do the units offer that overlap with other organizations? How might ATL operate to capitalize on its niche and maintain or expand funding? How might ATL position itself in relationship to faculty-based units to avoid losing funding as more and more of these centres develop on campus? Some of the answers to these questions may be achieved from an internal analysis of ATL guided by the following five key questions.

### How well is the present strategy working?

The competitive approach ATL uses is to provide a differentiated range of services that are not available elsewhere on campus. Clear standards to evaluate ATL's success are absent from ATL's strategic plan. However, several means that might be used for this type of evaluation are suggested below.

Table 1: Success Indicators for ATL

Success Indicators	Evaluation of level of success
Proportion of target population served	On a recent survey, respondents indicated that 22% had accessed ATL's services while 40% had accessed the campus teaching centre's services.
Cost effectiveness compared to other centres, both on campus and off	Smaller faculty-based centres may also be viewed as more cost-effective.
Partners' evaluations of services	Research is underway on this issue
Number of new media resources created	This isn't tracked effectively. Projects often take a long time to complete and there are some, which do not result in the development of resources.
Utilization of ATL's production studio	Below capacity.
Impact on teaching and learning on campus	This is tough one! But, ultimately an indicator critical to ATL's long-term competitive success.

Given that indicators such as profit margins are not relevant to ATL, one strategy for this centre is to benchmark its key activities against other educational technology centres both on and off campus. To keep its competitive advantage on campus, ATL must become proactive in determining standards for measuring its success and in developing strategies to achieve these standards.

### What are the organization's resource strengths and weaknesses and its external opportunities and threats?

A SWOT analysis is a review of an organization's resource strengths and weaknesses contrasted with its external opportunities and threats. This analysis enables planners to aim to produce a good fit between an organizations capability and the demands of its market situation. ATL's SWOT analysis appears in Table 2.

Table 2: SWOT Analysis for ATL

Potential Resource Strengths & Competitive Capabilities	Potential Resource Weaknesses and Competitive Deficiencies
<ul style="list-style-type: none"> <li>• expertise in instructional development and evaluation</li> <li>• technical expertise in new media</li> <li>• well-endowed technical facility</li> <li>• direct contact with VP Academic</li> <li>• recognized campus leader in instructional technology development</li> </ul>	<ul style="list-style-type: none"> <li>• under-utilized facility capacity</li> <li>• R &amp; D not adequately supported by skilled staff</li> <li>• greater emphasis on excellence in research rather than on superior teaching on campus</li> </ul>
Potential Opportunities for ATL	Potential External Threats
<ul style="list-style-type: none"> <li>• faculty-based units don't have resources for R &amp; D</li> <li>• increasing impetus for higher education to review curriculum</li> <li>• distance education programs expanding</li> <li>• ever increasing need for production support</li> </ul>	<ul style="list-style-type: none"> <li>• possible pressure to become a cost-recovery centre</li> <li>• shift to early-majority adopters changes typical client needs</li> <li>• faculty-based centres might duplicate services and request central funding</li> <li>• proliferation of workshops related to technology</li> </ul>

For ATL to sustain its position on campus, it must capitalize on internal resources that are *...valuable, rare, and costly-to-imitate...* (Barney, 1995). The combined skills of instructional development and educational technology meet these criteria as they are rarely found on campus and are hard to duplicate. These competencies are further augmented by ATL's financial capability to support research and development in the field of instructional technology. These competencies are what ATL does best and will insulate it from many of its external threats. Market opportunities to heed are the

needs of faculty-based units for support, the ever-increasing impetus on campus for new media production support, and the expanding number of distance education programs.

### Are the educational technology unit's prices and costs competitive?

One of ATL's most powerful clients is University Hall as it funds ATL. Therefore, it is essential that ATL demonstrate a solid return on investment for this funding. Faculty members are also clients. As most of ATL's services are available at no cost, a critical cost for faculty members is time spent on projects. ATL must manage its projects in a time efficient manner to satisfy these clients.

A value chain analysis reveals the core activities used to design, produce, market, deliver, and support a product or service. ATL's value chain is shown below. The lighter boxes indicate services that ATL does not provide.

Figure 2: ATL's Supply Chain



While value chains typically show a flow between one activity and the next, an important characteristic of ATL's value chain is that the activities are not necessarily integrated or sequential. Clients often access ATL at various segments of its value chain. For example, ATL staff members are frequently asked to provide technical assistance to faculty members who haven't been involved in any way with ATL previously. While random access to workshops may be supported, random access across the value chain leads to a fragmented, costly approach. Staff work with bits of projects out of context and aren't able to assure a high-quality outcome. As well, staff members are continually disrupted in their work and are unable to complete high priority projects. ATL has not been positioned as a help-desk service provider, yet much time is devoted to this sort of response to the detriment of other activities. On a strategic level, ATL's value chain should be integrated and streamlined to avoid falling into the *something for everyone* trap.

Porter (1996) stresses the importance of making trade-offs and integrating activities to assure that an organization achieves and maintains its competitive advantage.

*There will be constant pressures to compromise, relax trade-offs, and emulate rivals. One of the leader's jobs is to teach others in the organization about strategy—and to say no.*

(Porter, p 77)

Tradeoffs are prerequisite to strategic planning because of problems due to:

- inconsistencies in image and reputation
- different activities require different product configurations, different employee behavior, different skills, and different management systems
- limits due to internal coordination and control

For ATL, making trade-offs might mean providing technical support to only those clients that are involved with ATL on a complete project. Activities would also be aligned to focus on activities that are of a high value to ATL strategically. For example, other campus centres provide technical help-desk support or technical training workshops. ATL should divest itself of these activities and focus on activities related to maximizing the number and quality of instructional technology projects it supports. This sort of approach involves a number of difficult decisions for ATL. Its management will be well advised to consider Porter,

*...a strategic position is not sustainable unless there are trade-offs with other positions.*  
(Ibid, p 68)

In all of this, operational effectiveness must be assured (Porter, Strickland-Thompson, 2000). Activities in ATL's value chain are often highly time-consuming for ATL staff members and their

clients. Streamlining the analysis, design, and production process will be essential to effective operations. Project management is gradually evolving at ATL. It is a difficult process as many aspects of the university environment are at odds with a more business like production process.

### **How strong is the centre's competitive position?**

In a business environment, the success factors are used to evaluate a business's competitive advantage. In an academic environment, analyzing the success factors indicates the strengths and attributes of ATL in comparison to other centres on campus that also address teaching and/or educational technology. A preliminary outline of factors essential to ATL's success is listed below.

Table 3: Key Success factors for ATL

<b>Factors</b>
Instructional design expertise
Evaluation expertise
Technological expertise
Good communications & teaching skills
Reputation on campus
New product innovation capability
Project management skills
Academic research capability
Cost position relative to other campus centres
Production resources (hardware, software)
Customer service orientation

These success factors were circulated to ATL's management and staff who were asked to rank the importance of each factor. For several of the factors, staff responses diverged significantly from the director's. This suggests that more discussion needs to take place within ATL regarding its direction.

ATL should undertake to define its Key Factors for Success and reach understanding within the organization about the relative importance of each factor. Then ATL can use this inventory of factors to compare ATL's capabilities to other campus centres. For example, if ATL's production services are judged to be below par, while other centres are comparatively superior, ATL has at least two choices. It may choose to outsource the production aspects of projects to other units, or it could devote resources to increasing its capability in this area. Choices such as these impact whether or not ATL undertakes projects such as the Virtual Retina CD-ROM in the future.

### **What strategic issues do educational technology units face?**

A number of experiences such as the Virtual Retina project have compelled ATL to ask sharp questions about the effectiveness of the various services it offers. As a result ATL has come to realize that many of its strategies have been tailored to address the needs of educational technology's "early adopters" at the U of A (Rogers, 1995). ATL's focused differentiation of products and services for this group is increasingly out of alignment with the characteristics and needs of the growing population of instructors using technology who may be categorized as being part of the "early majority." The characteristics of this model are summarized below and contrasted with an alternative model that is more attuned to the early majority of educational technology users on campus

Table 4: The Shifting Needs of Clients

	<b>Early Adopter Model</b>	<b>Early Majority Model</b>
Client	instructor	department
Instructional design	idiosyncratic	team effort
Process	residency at ATL	project meetings
Production	instructor (or assistant)	project team
Outcome	resources for single course	resources for several sections or program
Time available	extensive	moderate
Risk at evaluation time for instructor	high	low

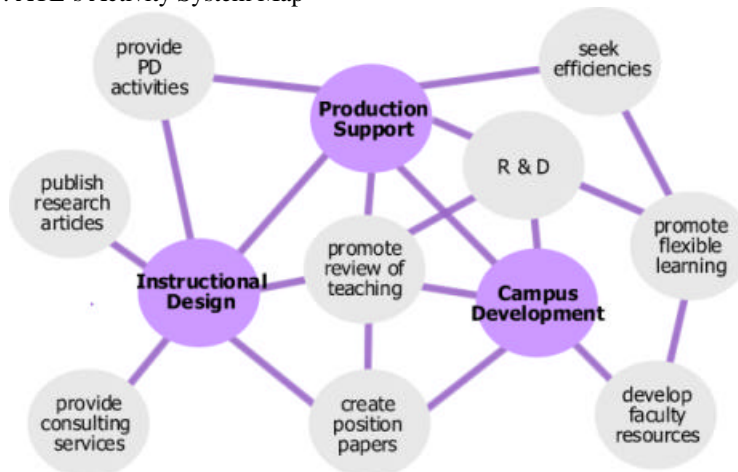
In reconsidering its strategies, ATL must avoid trying to straddle between two programs. This would occur if ATL attempts to combine significantly different approaches to professional development with existing programs and services. This approach is doomed to failure. Tradeoffs have to be made and accepted (Porter). The Virtual Retina project demonstrated something that as occurred on a number of ATL projects. The production model that required faculty members to learn then produce their own instructional resources is no longer a viable mode for faculty development. The early adopters' zeal for committing to long term, hands-on production is not matched by mainstream faculty members. Different strategies are needed for both production and faculty development.

In past strategic planning efforts, it seems that ATL management and staff have been swamped by the number and complexity of ATL's initiatives and have difficulty seeing the larger strategic structure of ATL's activities. The analysis methods described to this point enable people within an organization to develop an number of perspectives on both their external competitive environment and their internal capabilities to respond to this environment. Vanguard's Activity System Map is a good next step for ATL as it moves towards refining its existing strategic plan. This map represents the network of activities conducted by an organization. These types of maps...

...show how a company's strategic position is contained in a set of tailored activities designed to deliver it. (Porter, p 71)

A suggested Activity System Map for ATL is shown in Figure 3.

Figure 3: ATL's Activity System Map



After completing the Activity System Map a technology unit's management should ask the following sorts of questions:

- Are the activities consistent with the unit's overall positioning? (i.e. needs served, type of clients accessed)
- How do the activities within the unit reinforce or detract from each other?
- Could changes in how one activity is performed enable others to be phased out?
- What broad strategies and goals for the unit can be used to direct these activities?
- What are indicators for evaluating the success for each of these activities?

With an Activity Map the salient features of an organization become apparent. Broader strategies emerge and are readily translated into a concise strategic plan for the organization. At this point, educational technology units are ready to assess whether projects such as the Virtual Retina CD-ROM are aligned with the strategic plan.

## Conclusion

Only a sampling of possible methods for analyzing an organization's external competitive environment and internal capabilities have been explored. There is a wealth of resources designed for business and industry that can be used to free up blocked strategic planning. Project's such as the Virtual Retina inform an organization that it is entering a period of strategic dissonance, a time when successful strategies no longer work on all dimensions. At such times, strategic analysis methods

facilitate the asking and answering of fundamental questions related to direction, purpose, and relevance of core strategies used by an organization.

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To find out more about the Virtual Retina application, please visit: [www.virtualretina.com](http://www.virtualretina.com)



# PRIVACY AND ANONYMITY: ISSUES FOR ONLINE STUDENTS OR NOT?

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## Abstract

*With the advent of the Internet, email and increased use of online services issues of privacy, anonymity and security of personal information have evolved to a new level of importance. These issues have been discussed extensively as related to open access online services but are yet to be fully addressed for students of online classes. This pilot study sought to determine if students of a web-based distance education course had expectations of privacy, anonymity or issues of sharing personal information as related to the web mediated interactions of the online course. Students taking their first online course were found to have significantly higher concerns related to privacy issues than those who had previously taken online classes. With the increase in web-based distance education courses and entire degree programs being offered through the Internet it is important to determine student attitudes which might effect success of such programs and students.*

## Introduction

With the advent of the Internet, email and increased use of online services for web-based instruction, web enhanced or supported instruction (such as chat rooms, streaming video, and threaded discussions) issues of privacy, anonymity and security of personal information have evolved to a new level of importance. There has been a great deal of discussion and several studies (Bodi, 1998; Descy, 1997; Metivier-Carreiro & LaFollette, 1997; Singleton, 1998) conducted concerning privacy and anonymity of persons who use the Internet. For adult educators Holt (1998) reminds us, these concerns are not unique to the Internet, but “risks may be magnified by the power and reach of electronic systems” and are yet to be addressed for students of online classes.

Distance education and more specifically online courses bring into play a new set of *classroom* variables and factors (Holt, Kleiber, Swenson, Rees and Milton, 1998). Of interest here are the changing attitudes and expectations of distance education students who now are partaking of education through the electronic forum of the Internet. For example, within the traditional classroom a student’s appearance, and usually both gender and race, are apparent to fellow classmates. The face-to-face interaction often found in traditional educational settings usually results in students revealing components of their personalities, whether it is a tendency to be out spoken or a lack of participation that might be interpreted as shyness, or some other trait, often there is some insight into the person behind the student. This face-to-face interaction is missing in the online environment of a web-based distance education course.

Because of this environmental difference between traditional and online education we sought to determine if students of a web-based distance education course had expectations of privacy, anonymity or issues of sharing personal information as related to the web mediated interactions of the online course. For the purposes of this study privacy was defined as the release of personal information to other members of the online class, including name, home address, phone number, and posting of their picture while anonymity was considered to be the ability to conceal one’s identity and true personality, even use of an alias.

While it has been shown that individuals utilizing web-based commerce and social interactions, email and chat rooms have expectations of privacy, anonymity and personal information sharing subject to the implied security level of each activity and educators note that such issues should be of concern for online students (Holt, 1998) the literature does not contain specific research reflecting the attitudes of students in web-based distance educational environments towards these areas of personal concern.

## Methods

Students in an online distance education course offered by the Adult Learning and Technology Department of the College of Education at the University of Wyoming were approached via the announcements area of one of the course modules to volunteer to complete an online survey regarding attitudes towards issues of privacy, anonymity and personal information sharing in an online educational environment. The survey was given during the next to last week of the course, which was on distance education technology. The survey was built in Macromedia's Dreamweaver 3 software using radio buttons as the response method. The URL for the survey was given and students who chose to participate were asked to select the URL and complete a questionnaire consisting of a multiple choice demographics section plus 17 attitudes questions. The attitudes questions used a Likert scale of 5 categories from strongly agree to strongly disagree. Respondents submitted the completed questionnaires via the Internet by choosing a submit button. Likert responses were weighted 1 through 5. Responses to questions were tallied with a strong concern for privacy and/or anonymity resulting in a low score (1) while a strong preference for openness or no privacy or anonymity resulted in a high score (5). Of the 17 questions 9 were related to issues of privacy and 8 to issues of anonymity. Statistics were performed using SPSS.

## Results

Of the 29 students in the course 12 (41.4%) responded to the online survey, which is typical of online survey response rates. Of the respondents 58.3% (7) were female and 83.3% (10) were 41 years or older. A majority of the students were married (75%) with no children still living at home (83.3%). There was a fifty-fifty split between full time and part time student status and 58.3% were employed full time. Eight respondents had never taken a web-based distance education course (66.7%). Only 16.7% (2) of the responders had not taken traditional classroom style courses at the post-secondary level. The majority of responders were enrolled in a degree-seeking program (66.7%) at the graduate (50%) or undergraduate level (16.7%). The reasons most often cited for taking this online course were the flexibility of time (16.7%), inability to travel to the campus (25%), and that this course was only being offered as an online course at this time (33.3%). None of the respondents reported a preference for a web-based environment as their reason.

Weighted privacy and anonymity values were determined based on responses and number of questions pertaining to that category in the instrument. The scores were analyzed using independent t-test. Students who had not previously taken an online class were found to have a significantly lower mean score on privacy (showing more concern) than students who had taken 2 or more online classes ( $t = 2.47, p = .032$ ).

A principal component analysis extraction of the data showed a high degree of covariance, with all questions highly related as shown by the consistency of responses. The strongest reactions came to questions such as, "Should a student be able to use a pseudonym (as opposed to their real name), for chats and threaded discussions"? Ten of the twelve respondents either disagreed or strongly disagreed (83.3%) with the concept that students should be able to act anonymously. Of interest because of the relative neutrality of responses are mean results for some of the individual questions (5 = strongly agree, 3 = neutral, and 1 = strongly disagree); security of information that is shared in an online class (2.75), live video and audio for chats (3.5), sharing biographies at the beginning of the class (3.66) and students should post their picture as part of the introduction process (3.0). Mild concern was expressed over sharing personal data such as home phone numbers or addresses (2.08).

## Conclusion

While the sample number ( $n=12$ ) is low this pilot study shows that students who had not previously taken an online course had greater concerns of privacy than students who had prior online coursework. We know that users of chat rooms and e-commerce expect a certain level of security (Moss, 2000) it appears from this limited study that perhaps first time students of online distance education classes have similar concerns while "experienced online students do not. Perhaps this is in part due to the fact that experienced students realize they are entering a somewhat more secure or closed environment in the form of an online course.

Refinement of the questionnaire, increase in the number surveyed and performing the survey again on both first time students and experience online students would be needed to confirm the findings of a difference in attitudes related to issues of privacy in these two groups of students. With the increase in web-based distance education courses and entire degree programs being offered through

the Internet it is important to determine student attitudes which might effect success of such programs and students.

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# REDESIGNING THE DISTANCE EDUCATION COURSES OF ANADOLU UNIVERSITY IN TURKEY

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## Abstract

*Developments in communication technologies and instructional methods force distance education providers to change the way they try to help learners. Anadolu University as one of the biggest distance education providers in Turkey has been trying to adapt its distance education programs to this new situation occurred especially during 1990s. The University has developed a new distance education model and launched a project to help the learners. This model includes use of textbooks, television programs, computer-based instruction programs on CD-ROMs and Web sites either together or alone depends on the learners ability to access the equipments necessary for the materials. This paper aimed to explain details of this ongoing project in Anadolu University.*

## Introduction

Distance education, the structured teaching-learning process that is not limited by time and place, is one of the fastest growing applications of educational technology. This growth has occurred especially in the last decades of 20<sup>th</sup> Century. During this period, developments in computer based delivery systems and in instructional strategies have caused significant changes in the field of distance education. Distance learners have had better opportunities and freedom to determine when, where, what, and how to study since the distance education providers started to adapt their services according to these changes.

As one of the largest\* distance education providers, Anadolu University could not stay unaware of these changes in the field. Therefore, the University has launched a new project in 1999 about redesigning the distance learning courses in the light of past experiences and principles of instructional design.

This paper aimed to explain details of this ongoing project in Anadolu University. It is hoped that the explanations here will help readers to comprehend how a highly content-focused distance education system is trying to transform to a learner-centered system.

First, this paper will summarize some of the trends influencing the field of distance education. Next, it will give some of the current statistics about the Open Education Faculty of Anadolu University. Finally, the paper will clarify the details of the project and explain what has been done since the beginning of the project.

## Some of the Trends in Distance Education

Distance education has been influenced by the developments in many other fields since its pioneers. It is not the intent of this paper to explain all these fields and the developments. However there are two of them that have had major effects on recent implementations of distance education.

One of these is the field of communication technologies. Since distance learners and the instructor are separated, there is a need for an artificial communication medium that will provide a channel for information flow and interaction between them.

Distance education providers have successfully been using different forms of communication technologies for meeting this need. Print form was the first and the widely used one, but, as Spodik (1999) points out, audio and video broadcasting technologies helped to revolutionize the scope and capability of distance learning programs. However all these have brought tremendous financial cost and many restrictions on the learners.

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\* In 1998, the World Bank recognized Anadolu as the world's largest university (Potashnik & Capper, 1998).

On the other hand, for many (Harrasim, 1990; McIsaac & Gunawardena, 1996; Schrum, 1999) recent developments in computer based communication technologies opened new doors to distance education providers due to their unique characteristics such as speed of delivery and increased interaction. The practices have shown that computer based communication technologies helped the distance education providers to reach more geographically and physically separated individuals, to offer more interactivity among the learners, to incorporate new instructional methods, and above all to bring the distinctions between distance education and traditional education closer (McIsaac & Gunawardena, 1996).

Developments in the field of instructional psychology have also been influencing the distance education practices to a greater extent. Recent studies on learning have revealed that learning is a change in meaning constructed from experience (Newby, Stepich, Lehman & Russell, 1996), and after bringing his/her prior knowledge to the learning experience, the learner co-construct new meaning onto former knowledge through interaction with the material, with the other learners and with the instructor (Morphew, 2000). That is why this new approach has been called as constructivism, or constructivist learning. In general, a constructivist learning activity is more learner-focused and includes a set of tasks and resources available to learners for actively creating their own meaning in an authentic context rather than passively absorbing knowledge structures created by the instructor.

Tam (2000) indicates that when applied to the distance learning context, there is no doubt that constructivism and the use of new technologies will help transform significantly the way distance education should be conducted.

“... computer-mediated communications, computer-supported collaborative work, problem-based learning environments, and computer-based cognitive tools, for example, can offer the field of distance education alternative approaches to facilitate learning. These constructivist environments and tools can replace the deterministic teacher-controlled [content-focused] model of distance education with contextualized work environments, thinking tools, and conversation media that support the knowledge construction process in different settings.”

Especially during late 1990s, observable consequences and products of this approach have started to be seen in the distance education programs. For instance, Jonassen, Peck and Wilson's (1999) conceptual model of learning environments for technology gives details and examples about creating constructivist distance learning environments..

## **Distance Education in Anadolu University**

According to Daniel (1996) Anadolu University is one of the mega universities\* of the world because of its nearly 600.000 enrolled students.

The University was created in 1981 from an older institution, the Academy of Economics and Commercial Sciences of Eskisehir. In 1982, a school, named Open Education Faculty was founded in order to supply the demand of higher education.

By the 1982-1983 academic year, Open Education Faculty had enrolled 29,479 students in the fields of economics and business administration. By the 1999-2000 academic year, the number of the new enrolled students reached 182,000 in four 4 years programs (economics, business administration, preschool teacher education, English teacher education) and 166,000 in 22 other 2 years programs (e.g. export, banking and insurance, public relations, book keeping, tourism, hotel management, sale management), two of which are designed for the Turkish citizens living in different cities of Europe.

The Open Education Faculty is legally required to accept any applicant who scores at least 105 on national entrance exam (average score is around 160). There is an idea about taking anyone who wants to get in any program of the Faculty, but has not been applied yet.

The Open Education Faculty uses mostly printed texts and television programs as the course materials. All these materials are produced in-house. The Faculty has printing facilities and professional TV studios for the production of distance learning materials. More than 400 textbooks have been printed and 2.200 TV programs have been produced since the foundation. The Faculty broadcast nationwide six hours of programming everyday on Channel 4 of the Turkish Radio and Television Corporation.

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\* Mega-universities are large open universities, each of which enrolls more than 100,000 students per year.

In addition, there are 81 administrative centers throughout the country and in 58 of them students can attend noncompulsory evening classes several times per week to get the academic counseling.

The Faculty tries to bring new technologies into the system. For instance, a pilot marketing course was delivered through videoconferencing at a school in Kazakhstan. Also, in computer based instruction department, several samples for different courses are produced each year. However the system heavily relies on textbooks.

One of the main problems of the Open Education Faculty is the low graduation rate. According to most recent statistics, only 34% of those who enter the two years program earn degrees within two years, and just 23% of those who begin four-years programs in four years.

Studies have shown that 76% of the students holds part and full time jobs and having difficulty for leaving time for study. It is also determined that most of the students are not using the textbooks designed and written by the Faculty of Open Education. Instead the students find the books that are published by the private companies easier to read and understand, and also more helpful for themselves. It has been noticed that the main goal of these books is to prepare students to the exams instead of instruct. Thus, they include few explanations about the content but lots of practice.

The students list the problems about the Faculty of Open Education's textbooks as being very complicated, including long texts, having academic language, requiring lots of time to study, and providing few practice. The students indicated that because of these reasons they think the books are hard to read and understand.

## **The Project**

The low graduation rates, critics about the delivery systems, and trends in distance education have forced the Open Education Faculty to redesign its courses. Therefore, the Faculty has launched a new project in 1999 about redesigning the distance learning courses in the light of past experiences and principles of instructional design.

The project consists of four stages: Firstly, most of the Open Education Faculty programs started in different years so that each curriculum developed separately. As a result of this many courses that included almost the same content were offered and materials for these courses were produced. This was nothing but only vast of time, money and effort. Thus, in the first stage of the project, it was planned to re-develop the curriculum of each program and determined to give the priority to the four years programs (especially economics and business management). These courses re-developed and standardization secured among the programs. During this stage, content specialists worked with instructional designers to determine the main goal and objectives of each courses in the programs.

Secondly, as a result of critics about the current materials, the administration of the Open Education Faculty wanted to provide more appealing, effective, and efficient materials to the students. After several analyses, it has been decided to use multiple media formats for each course because of a constructivist idea that advices proving multiple representations of the knowledge to the learners for helping them in constructing their knowledge. A textbook with an accompanying computer-based instruction program on CD-ROM, a television program, and a web site were the media selected for the courses.

According to this selection, each medium is responsible for the different aspects of instruction process. In other words, textbook is the main source for providing information to the learners while television program shows the real life examples related to the information supplied through the textbook. Computer-based instruction program on CD-ROM is designed to overcome the lack of interactivity between the learner and the material. The Web site, on the other hand, that allow both synchronous and asynchronous communications not only among learners but also between learners and instructor is intended for the solution of other interactivity problems (learner to learner and learner to instructor). The main idea behind these sorts of uses of media is to help the learners to get advantages of different media attributes (Kozma, 1994).

However, it has been found out that most of the distance learners in Turkey do not have an opportunity to access a computer and/or Internet. According to recent figures only 8% of the Open Education Faculty students have access to computers although the Faculty has established 14 computer facility centers throughout the country since the early 1990s.

Also, some of the learners, especially who live in rural areas of Turkey, are not able to watch the television programs for varying reasons.

In order to overcome these problems, the all materials (textbooks, computer-based instruction programs, television programs and Web sites) are designed in a manner that each of them can provide all aspects of instruction process (e.g. motivating learners, providing information, giving practice and feedback, etc.). For instance, Web site has several links that takes learners to sites where they can get information about the topic, have opportunity to practice and get immediate and/or delayed feedback, and so on.

After selecting and designing the instructional media, thirdly, a pilot project is planned to be done in order to see effectiveness and appeal of materials produced according to instructional design principles. An instructional design team including an instructional designer, a graphic artist and a content specialist was formed in summer 1999. The main duties of this team were determined as preparing a model chapter and conducting a pilot test to see if the new approach (designing instructional materials according to the instructional design principles and theories) has positive effects on Open Education students.

The team, first, selected "law of demand and supply" as the topic of model chapter because the students studying in different Open Education programs found it as one of the most important and difficult topics. Then, the team prepared a model textbook chapter according to instructional design, visual communication, distance learning and adult learning principles. As a result of this, many new features such as advance organizers, attention-focusing devices, follow up activities, embedded tests, new graphical look are used in the chapter. Then a TV program specialist and a computer based instruction expert joined the team. They also worked collaboratively with the other members of the team.

After preparing all the materials, the team called the Open Education students in Eskisehir (a town where the University is located) to participate the pilot test. During the test, 15 voluntary participants are asked to study the chapter at home or work and take notes about the strengths, limitations, and time spend to study. Unfortunately the participants could not reach the tv program and the web-based instruction materials due to technical problems and the traditional belief of seeing the textbook main means of instruction. However they had chance to review the printed material. After completing, the students are asked join a face-to-face conversation about the materials and asked to mention again their ideas about the model chapter. Also, a test consist of items related to the topic covered in the chapter administered to the participants to see how well the model helped them to learn the content.

The participants' high scores and their positive remarks on the model chapter satisfied the team and the administration of the Faculty. All the participants got very high scores at the test administered right after they completed studying the materials. Some of the participants took the scheduled mid-term exams after the study and they verbally expressed that they did not have any problem answering the questions about the "Law of Demand and Supply".

All the participants also liked the idea of using an advance organizer, which was a short beginning of an article taken from a daily newspaper. The participants also found the recaps and the embedded test very beneficial; follow up activities and web addresses very useful. On the other hand, they thought that the warm-up questions at the beginning were quite difficult and were not interesting.

In addition, during the personal conversations the participants mentioned that the well-designed tv and computer based instruction programs might be very useful for the ones who have access to these programs.

Later, fourthly, the Faculty administration decided to use new materials during the 2001-2002 academic year. So that, course materials design teams were formed for each course and they started to work on the course materials on the bases of the model chapter on "Law of Demand and Supply", which was revised in the light of the participants suggestions, under the supervision and coordination of the instructional design department.

The core team usually consists of an instructional designer, a content specialist, a graphic artist and a coordinator. Besides tv program specialists and web/computer based instruction experts are joining the team.

According to the plans, these teams firstly focus on the textbook because it is a fact that textbooks are the ones almost all students easily reach. They start training writers about the new structure of the course materials and instructional design principles (advance organizers, instructional objectives, etc). After receiving the written chapter, the team members meet with graphic artists, and tv and web/computer based instruction specialists. While graphic artists add visuals into the text the tv programs, web pages and computer based instruction specialist starts producing the programs. The core team members secure the interrelations among all these materials. After completing all the materials,



they are revised by the course team. The team offer revisions if there is a need. After revisions and duplicating, all the materials are packed together as the course materials.

But, due to lack of enough time and qualified human resources, production of web/computer based instruction programs were postponed. So the project has continued with the production of textbooks and tv programs.

There have been some other obstacles in the design and development procedure, too. One of the very important one is the limitation of the number of the instructional designers in Turkey, especially in Anadolu University. This number is limited only to the fingers of a hand. Due to this limitation, each instructional designer had to be in different course teams. This caused the problem of not focusing on the each course intensively. However, during the project several new graduates of the Educational Communications and Planning Department of Anadolu University helped these instructional designers and through this participation they got training about the instructional design and instructional media. For the other courses they will take a part in course teams as the instructional designers.

Another important obstacle was the other ongoing projects in the University and the Faculty. Because of those, several facilities such as tv studios and printing office could not be used by the team, and some of the project members such as graphic artists and content specialists could not join the whole procedure. As a consequence of this, all the timing plans failed and left a few times –like 3 months- to design and development of the courses. So that, the Faculty administration has decided apply this project on mathematics, economics and business management courses. Now course teams are working on instructional materials of these courses.

## **Conclusion**

Developments in communication technologies and instructional methods force distance education providers to change the way they try to help learners. Anadolu University as one of the biggest distance education providers in Turkey has been trying to adapt its distance education programs to this new situation occurred especially during 1990s. The University has developed a new distance education model and launched a project to help the learners. This model includes use of textbooks, television programs, computer-based instruction programs on CD-ROMs and Web sites either together or alone depends on the learners ability to access the equipments necessary for the materials.

Although everything planned at the beginning of the project could not be done due to several reasons, it can be easily asserted that this effort has several important effects on Turkish distance education system.

First of all, it introduced the field and the process of instructional design to the people who are developing products (textbooks, web based education, computer based education, educational tv programs) for instructional purposes and unaware of instructional design. Also, it has revealed the strength of instructional design to the people who are aware of instructional design but do not appreciate it. Besides it gave a clear idea about what kinds of features a textbook should have and what sorts of processes should be completed during the development of an effective textbook. These are significant for the development of the instructional design field in Turkey. Now more and more people have started talking about systematic and systemic design of instruction.

Second, after this effort, both Faculty of Open Education and the University have appreciated the dynamic nature of distance education field and decided to keep up developments in the field. That means the Faculty is trying to improve its services through the effective use of instructional media and giving up not to looking at the reasons of low graduation rates. Thus, a new department, instructional design department, established under the Open Education Faculty and new instructional designers are employed.

However, all these are not enough. In order to remove all kinds of barriers on the applications of more effective, efficient, and appealing delivery methods and technologies, the administrators of the distance education providers must take serious steps.

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## ACCESSING CBT LEARNERS' STUDY SKILLS

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### Purpose

The purpose of the study (Hemphill, 2000) was to determine if learners who were given individualized learner strategies based on a survey of their needs at the time of instruction score higher than those learners who were not given the strategies. A proof-of-concept learner profile instrument was developed to provide specific strategies to learners to help them increase their effectiveness in taking computer-based training (CBT) courses. The short survey assesses the learners' learning needs and generates a customized learner profile with individualized strategies for each learner's training needs, learning and environmental preferences, and optimum use of learner-controlled program features for the task at hand.

### Rationale

In learner-controlled environments such as computer-based training, learner involvement is important to make the training meaningful. Unfortunately many learners are not capable of selecting appropriate learning strategies and software options that enhance their instruction (Clark, 1984; Yoon, 1994). Individual differences such as prior knowledge of related tasks and motivation for completing the task appear to be good predictors of future achievement (Jonassen and Grabowski, 1993; Garcia and Pintrich, 1995). Metacognitive strategies also allow learners to perform effectively in self-regulated environments (Gay, Trumball, & Mazur, 1991). Self-efficacy, cognitive strategies, and learning styles may also affect learning. A number of researchers (Hannafin & Sullivan, 1996; Nathenson & Henderson, 1980) have recognized the need for a preinstructional survey to assess the learners' individual characteristics and needs at the time of instruction and then provide the learners with a profile of individualized strategies for improving their achievement. Unfortunately, available learner surveys usually focus on the general prescriptive and evaluative purposes and are not appropriate for suggesting learning strategies for specific CBT training applications.

### Procedure

The learner profile and survey instrument prototype was developed and then tested at three different colleges to determine if there was a relationship between the use of the suggested learner strategies and the learners' achievement on the posttest. All subjects took the learner profile survey, a pretest, the software-training course, a posttest, and an exit survey. The treatment groups also received learner profiles with individualized suggested strategies. The subjects in the treatment groups were rated on their compliance to the suggested strategies.

### Data Analysis

The experimental analysis was as follows. Pretest and posttest scores were compared using a t-test and descriptive statistics, as was the length of time the subjects spent completing the training. The treatment group subjects' and raters' judgment of the subjects' compliance to following the strategies suggested were correlated. Descriptive statistics were done on the treatment group subjects' opinion of which strategies were the most useful and least useful. The instrument questions analysis was as follows. The distractability and perceptual modality construct survey items were analyzed using frequency data. A principal component analysis of the results of the pilot group was used to analyze the construct validity of the items related to the motivation, self-efficacy, and metacognitive awareness constructs. Those items that fit together in a common construct were used to determine which strategies the learners received in their learner profile.

## **Results and Discussion**

The findings of the experimental study revealed that there was a statistically significance difference between the achievement score percent of subjects who followed the learning strategies suggested in their learner profiles and of subjects who were not given the strategies or did not use the strategies. The time spent in the course and the students' rating of the usefulness of the training course did not vary much across the groups.

Interestingly, the importance of learners complying with the strategies given and how to measure that compliance emerged as an important component of this study. The reasons for not following the instructions included the learners believing that the strategies were not useful to them, that working through a strategy took too long, and that they already had strategies they used and they did not want to try others. This study may encourage educators and developers to look more closely at suggesting strategies that are unique to each learner at the time of instruction and at the importance of having the learners use the suggested strategies.

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## ONLINE STAFF DEVELOPMENT: A COLLABORATIVE APPROACH

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### Introduction

The public has raised numerous concerns regarding the quality of teaching in our schools. Political and professional factions have developed outcomes and standards for assessing not only student learning but also teaching performance. To enhance our K-12 educational systems, a variety of professional approaches are being explored and proposed. For example, the National Commission on Teaching & America's Future's 1996 report, "What Matters Most: Teaching and America's Future," outlines several changes in professional development programs. One change proposed is to organize teacher education and professional development around standards for students and teachers. Another suggestion is developing teacher academies, partnerships of schools/universities, and learning networks transcending school boundaries. Another example is the California Formative Assessment and Support System for Teachers (CFASST) which emphasizes the point of investing in teacher development and sustained examination of teaching performance over time will increase success for students and teachers alike (Oliebe, 1999).

According to the NASSP Bulletin, October 2000, "An Ambitious Vision of Professional Development for Teachers," quality teacher professional development has never been more important with the ever increasing intensity of challenges and expectations for quality education. (Ganser, 2000). Darling-Hammond and McLaughlin (1996) expressed increasing teacher effectiveness and student achievement will require teachers to learn not only new skills and perspectives but also unlearn practices and beliefs that they have held onto for years. Guskey and Sparks (1996) use the terms – content, process, and context – as guidelines in developing quality professional development. Content in a professional development offering should deepen one's understanding of an academic discipline and teaching/learning principles. How these professional development experiences are planned, organized, and implemented reflects the process. Corcoran (1995) describes the most effective experiences in professional development occur when teachers are engaged in designed, intensive intellectual, social, and emotional experiences. The third quality, context, is aimed at providing an inservice environment for improving teaching through such things as accessibility to resources, meeting individual and organizational needs, and learning activities that are experiential in nature.

Professional development should reflect societal demands and skills needed for successful participation in one's culture for teachers and students alike. Technology has become the driver in much of our cultural environment. Teachers must not only understand the implications of our existing technological society but also use its tools in a variety of ways to show their usefulness in teaching and learning. Schofield (1995) describes a situation all too familiar that computers do not fulfill our expectations in schools because teachers are not shown how to integrate this new technology into their instruction, or into their students' learning processes. In describing a "generational model for professional development," Caverly, Peterson, and Mandeville (1997) cite we must not just "train" teachers in technology but "educate" then to think differently about how to use it in their classrooms. In a special eSchool News report, "Professional Development: Bringing Technology into the Classroom Effectively," it states that teachers use computers regularly at home and at school for lesson planning, correspondence, and personal business. However, the vast majority of them are not using them in their classrooms for instructional purposes (Levin-Epstein, 2000).

We need to insure that teachers are capitalizing upon the recent technological advances and tools for learning. When teachers are actively involved in using and applying technological tools in various learning situations, the possibilities of using technology in one's own classroom is enhanced. The following case study describes a collaborative attempt to incorporate the use of various technological tools in delivering an onsite version of a traditional professional development program.

## **A Case Study of Virtual Staff Development**

The Flint Hills Special Educational Cooperative program director contacted teacher educators in the Teachers College at Emporia State University about the possibility of faculty being involved in a program called Fundamental 4MAT Level One training. This training was made possible through a grant addressing the integration of learning styles and the latest information on brain research into lesson planning. During this inservice training, corporate trainers from About Learning Inc., expressed an interest in making this training accessible to individual teachers in rural and international areas. Subsequent discussions involving Emporia State University professors, the Flint Hills Special Educational Cooperative, About Learning and MacLean Media led to a collaborative distance learning venture.

Each organization brought special ingredients to the potential development of the online delivery of Fundamental 4MAT Level One training. Emporia State University is the premier preservice/inservice teacher training institution in the State of Kansas. It is always looking for more effective ways to address needs and interests of teachers in the state. In addition, increasing interest in technology integration within the K-12 classroom setting and exploring the potential of a distance learning delivery model for teacher training are topics of continuing interest. The Flint Hills Special Educational Cooperative provides resources and in-services for eight local school districts. The Cooperative is always looking for a more effective way to serve a broad geographical area of clientele and researching ways to make staff development more economically and educationally effective. About Learning, Inc. is an established private corporation which developed a product called Fundamental 4MAT training. This training involves learning styles, diversity in the classroom and lesson plan design. About Learning, Inc. expressed an interest in economically delivering its fundamental training to teachers in remote areas via distance learning. MacLean Media is a broad based company involved in producing a variety of educational materials. Among its clients is Aboutlearning, Inc.

After much discussion between the collaborative partners, a decision was made to pursue the possibility of converting a traditional face-to-face training program into an online experience. This staff development endeavor would utilize university faculty, school district personnel and corporate partners. To convert a traditional training program into an online experience created several concerns. The first concern was focusing on adapting written and audiovisual materials developed by Aboutlearning, Inc. into web course delivery system with CD-ROM supplementation. Emporia State University teacher educators investigated the four learning styles that are assessed within the 4MAT system, mapping out the various technologies that would be most appropriate for each style. Type One learners are the most social of the four types. They are interested in real time collaboration and communication within a classroom setting. It was felt that live chat, threaded discussion forums, video conferences, and e-mail would be tools that would allow Type One learners to operate within the comfort zone of their learning style. Type Two learners are more interested in the facts and information concerning the course. It was reasoned that online surveys, streamed lectures, formal discussions, and a very structured technology framework would benefit them the most. Type Three learners prefer to “just do it.” They prefer to be active participants in a very structured learning process. Utilizing step-by-step tutorials, working with relevant software tools, and surfing the Internet in a structured way would be activities that would match best with their learning style. Type Four are those who are constantly coming up with new ideas. They hate to be limited by a structured approach, preferring to allow their creative energies to flourish in anyway they like. Unstructured chat, open forum discussions, paint programs, and web page development outside of the typical template approach are activities that lend themselves to this type of learner.

Because of the interactive nature of the traditional training approach, it was imperative to provide cooperative learning and student interactive experiences, to preserve the integrity of Aboutlearning's program.

We chose to focus on several interactive vehicles in the development of this online course: e-mail, threaded forum discussions, and live chat. Live chat can be a difficult medium to utilize successfully, and at best is often labeled as controlled chaos. We chose to use live chat for topical discussions, mixed and homogenous learning style groups, and special invited speakers. It was made clear to the students that the chat rooms were also available to them whenever they wanted to work with their partners discussing their lesson plan projects.

One major component of the training required lesson plan assistance and evaluation opportunities. This is critical as students both develop and critique each other's final projects—a

4MAT lesson plan built around the four learning styles, including left and right brain activities. Students participated in a class brainstorming forum to create their initial ideas. They exchanged lesson plan ideas and critiques via e-mail with their partners. To facilitate this process, a separate website (<http://www.lessonbank.com/>) was developed to allow students a structured area to post and evaluate lesson plans. At this site their final postings are open for class review. Interestingly, this site is now a repository of hundreds of 4MAT lesson plans from both students and trainers available to anyone interested in lesson plan design.

What were the impressions of teachers in our case study toward online delivery professional delivery courses? Teachers liked the highly organized, logical structure of the online product. Having an overall course outline on the course website enabled teachers to plan ahead and have the option of anytime, anywhere to fit their daily schedules to complete assignments. Teachers favored the multi-dimensional resource applications of using traditional hard copy materials, links to internet information and a comprehensive CD containing self evaluative assessment instruments, graphical representation and audio-visual mini-lectures of related materials. Online forum discussions were looked upon favorably as opportunities to read and digest information before having to respond to classmates. Also, it was indicated that this form of discussion could not be dominated by a very few or curtailed by a busy onsite class schedule. It allowed everyone input on significant course issues – a true expression of diversity. Finally, many course participants expressed that online, distance learning was the wave of the future in education.

Besides several strengths, online delivery of Fundamental Level One 4MAT training had its shortcomings. The issue of no face-to-face interactions did bother some individuals. The isolation of reading and working alone existed and in some cases, created frustrations concerning the use of various technologies, difficulties with some CD applications, and general technological “glitches.” In the same token, e-mail correspondence and responses between instructors and students alike were expected to be “instant” because of the speed of e-mail technology. Anything less than this speed of response created negative impressions. For some students, a web-based course tends to work against developing personal relationships with classmates since e-mail and forum discussion taketime to transcribe and to communicate with others.

## **Implications of Online Staff Development**

The conversion of the traditional Fundamental Level One 4MAT training to an online delivery was considered successful. Much of this success was due to the already apparent structure of the onsite training program designed by Aboutlearning, Inc. which centered around learning styles and brain-based research. All that was necessary for the online designers was to employ appropriate technological tools for an effective online delivery. The virtual online course can address and retain the integrity of the staff development training if the technological tools are appropriate and implemented properly.

The National Board for Professional Teaching Standards (NBPTS) has designed not only certification standards for accomplished teachers but it has also been looking at teacher growth over one’s professional life span. (Diez & Blackwell, 1999). Among the NBPTS charges is a recommendation to design graduate teacher programs with three critical factors which promote teacher growth: (1) reflection on practice, (2) systematic inquiry into practice, and (3) collaboration with others in meeting learner’s needs. Reflection on practice, as cited by the NBPTS, is a teacher’s ability to explain what they do and why they do certain things in their classrooms. For example, online forum discussions allowed all teachers time to reflect and express well-thought out responses. Challenging assignments and online discussion allows for the observance of diversity among teaching practices. Systematic inquiry into practice is illustrated by the emphasis in the online 4MAT training to incorporate learning style and left-right brain research into one’s lesson planning. This quality was enhanced by an online lesson bank showing a variety of applications utilizing such research information. Collaboration with others in meeting learner’s needs was accomplished by the diversity of teachers from different geographical regions and school settings, using such technological tools for lesson critiquing through partner e-mail, live chats on various teaching issues, and forums on best practices.

As Landeck (2000, p.42) states, “To meet the different learning styles and levels of tech expertise of their staff, many educational institutions are looking at a combination of online and face-to-face instruction.” Online delivery systems can offer attractive educational and economical options to school inservice formats. Hybrid options need to be explored where onsite-online combinations can be



structured to fit individual school schedules, help to resolve critical need areas within the educational framework, and encourage cooperative collaborations on school staffs. In addition, hybrid options can alleviate administrative decisions involving financial issues concerning substitute teachers and teacher time away from the classroom, which inevitably effects student learning and security.

The time has come to consider online experiences as a viable option in professional development. Using today's technological tools incorporated into relevant, topical inservices for teachers, can not only insure an effective and economical delivery method of enhancing academic and pedagogical knowledges but also showcase the use of various technological tools to enrich the learning environments of students.

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## **KNOWLEDGE CONSTRUCTION COMMUNITY FOR ONLINE BOOK REVIEW**

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# KNOWLEDGE CONSTRUCTION COMMUNITY FOR ONLINE BOOK REVIEW

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## Abstract

*This project is the development of and the evaluation of an online educational book review site. Current book reviews cannot be published in a timely fashion. Usually, a single review is published representing the views of a single individual. Focusing on these two flaws, Online Educational Book Review Group publishes book reviews shortly after the book is available; it is a site that has feature reviews from a variety of perspectives, such as peer evaluations, invited reviews from well-known scholars, authors, publishers, and a discussion board area for anyone who wishes to make comments. It is operated entirely through a web-based database-driven design that supports the submission, review, editing, and publication processes online.*

## Introduction

Knowledge construction provides an ideal learning environment. Maurer and Davidson (1998) state: "The ultimate purpose of instructional technology's support of an exciting, quality learning curricula explicitly is to encourage children to discover basic data (facts), to integrate and interpret those data into information, and to apply that information into action to create knowledge (p. 4)." The current design of many online instructions features the distribution of static information, or a linear approach. This does not provide an opportunity for learners to pursue critical thinking or construct their own knowledge. Frequently, instructors, or content experts deliver the information, and the learners are denied an opportunity to contribute. This type of instruction is not individualized it is canned knowledge that is teacher-centered. Many instructions provide a long list of information without a search capability. Even when a search function is available, the search capability lacks focus, like Internet search engines and is a very time consuming process. Online bulletin boards and forums have been considered and implemented as knowledge construction learning environments. However, bulletin boards and forums only provide for the simple exchange of ideas. It ignores the sophisticated human thinking process and does not generate greater knowledge construction.

There are at least two disadvantages surrounding the current book review process: a) The reviews are not published in a timely fashion and b) there is no provision to support interaction. Publishing a book may take six to twelve months and with the current review process one to two years may have elapsed before a book review is published. The current schema only provides for the judgment of a single individual, without provision for the opinions of different people or an opportunity for interaction. The Online Educational Book Review Project is being formed to address the problems with the current book review process and to foster the formation of an authentic knowledge construction community.

## Implementation Of Knowledge Construction

The Internet has become a primary source of daily information and possesses the potential for knowledge construction. An enormous amount of information is presented to us everyday. The Internet and WWW have been used for the presentation and delivery of information. Obtaining information has never been an extremely critical issue for people, particularly in a learning environment. Presently there is an avalanche of information that is constantly bombarding the populace. The sheer excess is overwhelming and difficult for an ordinary human being to process. Shenk (1999) argued, "The Web right now is nothing more than a repository of convenience." (p. 22) This phenomenon also occurs in an online learning environment and poses a management problem for both learners and instructors (Tu, 2000). Current online instructional designs rarely support a learning style that engenders knowledge construction and fails to reflect the complexities of human thinking.

Shenk (1999) warned that users should be careful not to let the Internet govern the way they think. Frequently online communications occur to enable the simple exchange of ideas but the threading that occurs in an online bulletin board, for example, does not satisfy the complexity of human thinking. Learners lack the resources to determine the accuracy, timeliness, and social context of the information presented to them. These facts about the information received, accuracy, timeliness and social context, are critical to the process of knowledge construction.

Selective multiple resources play an important role in the knowledge construction process. An ideal learning environment engages students in deep thinking, provides multiple viewpoints, supports reflection, and offers frequent feedback and guidance toward a higher standard. For example, before reading or buying a book, people will normally gather information from different resources, such as their friends, colleagues, or relatives, “word-of-mouth” or “appeals to authority,” or information may be received from multiple mass media reporting agencies. After gathering or receiving information from multiple resources, people will question, filter, claim, summarize, synthesize, predict, and generate a new set of knowledge. For example, in the class setting, recommended teachers provide texts and references in papers can help to filter the useful information from the useless information that may be provided from friends and colleagues.

## **Architecture Of The Internet**

The architecture of Internet information delivery does not support information structure in a meaningful way. Therefore, developing tools, which foster self-improving and knowledge construction communities is very important. We should move beyond a forum for simply exchanging ideas and opinions, to structures, which rapidly capture and reflect knowledge and foster rapid accumulation and growth of a community’s forces. In a learning community, one has the chance to make contributions and each contribution should generate values and more chances for knowledge construction. Learner’s contribute and quickly find the best resources and opportunities to negotiate which items are key to knowledge mining and knowledge construction. Online database, XHTML, XML, and artificial intelligent (AI) are promising technologies to support knowledge construction environment.

## **Theoretical Framework**

### **Automated Collaborative Information Filtering**

Automated Collaborative Filtering of information (ACF) operates for the distribution of opinions and ideas in society and facilitates contacts between people with common interests (Chislenko, 1997). ACF enhances existing mechanisms of knowledge distribution, increases their efficiency, optimizes knowledge processing in the society, and accelerates the evolution of ideas in practically all subject areas; and, also, provides a superior tool for information retrieval systems that facilitate users’ knowledge construction in a meaningful and personalized way. As an artificial system that integrates and processes knowledge of multiple human participants, ACF represents an intermediate stage between human and purely artificial intelligence and lays the foundation for the future knowledge construction.

People must possess both the necessary general knowledge and the special information relevant to their particular situation to make efficient personal selections. The collection of necessary information requires that one determine which items deserve their attention. This determination requires the exchange of personal experiences among individuals and the sharing of personalized advice on specific issues. When someone is confronted by the necessity of making a decision about an unknown situation, they can ask advice of their friends, and follow their suggestions. Here, one’s circle of acquaintances effectively plays the role of an information filter, designating the most relevant options and providing leads for further exploration.

Recker and Lawless (1999) noted the potentials of implementing ACF into a learning environment. They argued that three issues are important in implementing ACF into instruction: a) Information about who contributes opinions is as important as the contribution itself, b) because contributors form a community, they have their own language and set of values; c) evaluating information sources and contributing rating is a metacognitive activity.

#### **Potential of an Online Database for Knowledge Construction**

Online databases provide opportunities to facilitate knowledge construction or knowledge mining. Learners are required to perform intentional searches and the information obtained is

contextualized and personalized. This process encourages meaningful and higher-order thinking.

Student publishing and peer evaluation that occur on an online database (Tu, 1999) propagate improved quality in students' work. Jonassen, Davidson, Collins, Campbell, and Hagg (1995) argued that reflecting upon knowledge, stating learning intentions, and publishing ideas to a communal database produce cumulative, progressive results for the community/group.

### **Online Educational Book Review Project**

The Online Educational Book Review Project is an Internet web site community that provides a forum for education book reviews by authors, publishers, professional book reviewers, and regular consumers. It offers each an equal opportunity to contribute their professional opinions.

To enter the online community, users are required to create a new account to become a community member and provide basic profiles that can be accessed by other community members. A logging on process is required when a member accesses the community. The open page working as information agent is customized to provide members with news, new review messages, and recommending activities according members' profiles etc.

Members can perform a search function to identify books and book review messages. The messages can be retrieved linearly or non-linearly. Members can contribute book review messages by completing the online form with fields for message title, keywords, and rating etc. All of procedures are performed on the browser and access is designed to be user friendly.

This knowledge construction community for book review is a learning community for anyone who is interested to learning about educational books. The target audience is composed of anyone who is interested in certain books or would like to discuss certain books. In phase one, classroom teachers can integrate this knowledge construction community into their class reading and reading report/summary/critique assignments. The book topics range from educational philosophical content to children's storybooks. A special arrangement can be made to accommodate class reading and report projects to a classroom community.

### **Conclusions**

*The Online Educational Book Review Project with web-based database utilization enhances an information filtering learning environment, supports the complex human information process, and fosters authentic knowledge construction. It is able to capture and reflect knowledge and foster accumulation and growth of a community's forces. This concept can also be implemented to enable learners and instructors to find and form collaborative teams around mutual goals, skills, and processes. New technologies, such as XHTML, XML and artificial intelligence, can be applied to the online database in the future.*

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## UNLOCKING THE GATES TO THE KINGDOM: DESIGNING WEB PAGES FOR ACCESSIBILITY

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Although the use and availability of information resources on the Internet have skyrocketed over the last few years, cyberspace has predominantly been a domain of persons without physical or mental disabilities. While the Internet is easily accessible to individuals without disabilities, for all practical purposes the gates to cyberspace have been closed and locked for persons with disabilities. According to Tim Berners-Lee, World Wide Web Consortium Director and inventor of the World Wide Web, “*The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect.*”

The development of web pages that exclude persons with disabilities is unfortunate because these individuals often have the most to gain from Internet technology. Access to Internet technology has the potential to increase or enhance the productivity and independence of persons with disabilities. In fact, access to the Web may be more critical for individuals with disabilities than for the general population who can access information resources using conventional delivery systems. For example:

- Persons with disabilities may be location-bound. These individuals could use the Internet to shop for almost anything, research health questions, participate in on-line discussions, and contact friends and family.
- Persons who are blind may wait indefinitely for information to be made available in Braille or audiotape formats. These individuals could use the Internet to acquire access to the same information at about the same time it is available to persons who are sighted.
- Persons who are unable to hold a pen or use a mouse or keyboard could use speech recognition software to accomplish the daily routines and tasks of life.

While it is difficult to identify who uses the Internet, a variety of organizations and methods have been used to capture data that defines the audience of Internet users. Kaye (2000) analyzed national survey data to determine computer and Internet use among people with disabilities to determine that people with disabilities have considerably less access to the Internet when compared to people with no disabilities--11.4% versus 31.1%. Kaye concluded that while people with disabilities have the most to gain from Internet technology, the potential benefits of this technology are far from being realized. According to Kaye the problem is one of access that is a result of limited ownership of computer technology and specialized software by persons with disabilities and the lack of user interfaces that encourage use of the technology among people with disabilities.

The Georgia Tech Graphics, Visualization and Usability Center (GVU) conducts a large scale survey in April and October of each year (available at [http://www.gvu.gatech.edu/user\\_surveys/](http://www.gvu.gatech.edu/user_surveys/)). Beginning with the second survey conducted in October, 1994, respondents were asked about their disability status. In October, 1994, 5.11% of the respondents indicated they had a disability. The tenth and latest survey conducted in October, 1998, indicated that the proportion of respondents with disabilities increased to 7.68%. In all GVU surveys the Vision category was identified by over half the respondents who indicated they have a disability. Although this survey confirms the incidence of Internet use among people with disabilities is low (approximately 7% -8%) when compared to the general population, these low numbers may be a self-fulfilling indication that people with disabilities do not have access to the Internet or have difficulties in accessing information on the World Wide Web.

Web pages often do not allow for the eventuality that some web surfers may not be able to see, hear, move, or process some forms of information. Other web surfers may have difficulty reading or comprehending text or may not be able to use a mouse or keyboard. Many experienced web designers and authors, however, are completely unaware of accessibility issues and, therefore, have little or no experience in making their web pages usable by persons who cannot see the screen or use a mouse the same way that the web page authors do. They have what Bartlett (1999) calls a “skewed mindset” in which they develop web pages to convey content visually. Jane Jarrow, president of

Disability Access and Information Support, explains that there is an art to making web pages more accessible “but people don’t think to do it.” (Carnevale, 1999).

Adjusting browser preferences and using assistive technologies may lower the access barriers to web pages, but the best method for providing equal accessibility is by building accessibility features into the web site itself (Casey, 1999). Much of what web page authors can do to make web pages more accessible is relatively simple and can be achieved through proper design strategies using the accessibility features of HTML 4.01 and other web authoring resources. Web pages that are accessible to people with disabilities are highly accessible to everyone. Thus, web accessibility is a design issue. Design strategies that create accessible web pages also facilitate the creation of well-designed web pages. Improvements to a web page or site that enable web surfers with disabilities to access it also improve the web page for all surfers.

The World Wide Web Consortium (W3C) has recognized a disparity in accessibility to the Web between persons with and without disabilities and has responded by developing a set of web page design standards that specifically address the issue of web accessibility. Web accessibility is based on design principles that provide for the development of web pages to accommodate the needs of a broad range of users, computers, and telecommunications systems without regard to age or disability. When a web site is accessible, anyone browsing the site should be able to gain a complete understanding of the information presented on the site as well as have an undiminished ability to interact with the site. The W3C has embraced the issue of accessibility through its Web Accessibility Initiative (WAI). The WAI has developed a set of guidelines, the Web Content Accessibility Guidelines, for use by web page authors to incorporate accessibility features into the design of web pages. The purpose of this paper is to describe web page design principles and strategies based on the WAI’s guidelines that will facilitate the development of web pages that open the gates of the virtual kingdom to persons with disabilities.

## **The W3c Web Accessibility Initiative**

### **Who Is the World Wide Web Consortium?**

In October 1994, Tim Berners-Lee, inventor of the Web, founded the World Wide Web Consortium (W3C) at the Massachusetts Institute of Technology, Laboratory for Computer Science (MIT/LCS). The W3C was created to promote and manage the evolution of the Internet and to ensure its interoperability. The W3C has more than 400 Member organizations from around the world and is financed by its members and by public funds. Membership in the W3C is available to any organization. Along with MIT/LCS in the United States, the W3C is jointly hosted at sites in France and Japan and W3C offices are located in 11 other countries.

W3C activities and other work are organized into four domains: 1) Architecture Domain to develop the underlying technologies of the Web; 2) Technology and Society Domain to understand ethical and legal issues from a new international perspective and in light of new technology; 3) User Interface Domain to improve user interaction with the Web including work on formats and languages; and 4) Web Accessibility Initiative to pursue accessibility of the Web through five primary areas of work: technology, guidelines, tools, education and outreach, and research and development. The W3C has published more than 20 technical specifications for the Web’s infrastructure since its inception. Each specification not only builds on its predecessor, but is designed to integrate with future specifications as well.

### **The Web Accessibility Initiative**

The Web Accessibility Initiative (WAI) is an official domain of W3C. The WAI works across all the other domains and works internationally in all three host sites of the W3C. The WAI is sponsored by representatives of web development industries, disability organizations, research organizations, and government. Some of the WAI sponsors include the National Science Foundation, National Institute on Disability and Rehabilitation Research, Microsoft, IBM, Lotus Development, and NCR.



To facilitate the efforts of promoting Web accessibility, the WAI joined forces with the W3C HTML Working Group in the design of HTML 4.0 and in December, 1997, HTML 4.0 became a W3C recommendation (see <http://www.w3.org/TR/REC-html40/>). In May, 1998, an official W3C recommendation for Cascading Style Sheets, Level 2, (CSS2) was issued (see [www.w3.org/TR/REC-CSS2/](http://www.w3.org/TR/REC-CSS2/)). In May, 1999, the WAI issued the Web Content Accessibility Guidelines 1.0 ( see [www.w3.org/TR/WAI-WEBCONTENT/](http://www.w3.org/TR/WAI-WEBCONTENT/)). These guidelines incorporated the recommendations of HTML 4.0 and CSS2 and were intended for use by all web content developers including page authors, site designers, and developers of authoring tools.

## **Web Content Accessibility Guidelines 1.0**

The Web Content Accessibility Guidelines (WCAG) consist of 14 guidelines. Each of the guidelines of the WCAG is comprised of multiple checkpoints or sub-guidelines. Assigned to each of the checkpoints is a priority level that is based on the checkpoint's potential impact on accessibility. Priority 1 checkpoints are "must satisfy" requirements without which some groups will find it impossible to access information in a web page. Priority 2 checkpoints are "should satisfy" requirements without which one or more groups will find it difficult to access information in a web page. Priority 3 checkpoints are "may address" requirements without which one or more groups will find it somewhat difficult to access information in a web page.

The WCAG provide for three levels of conformity to the guidelines: Level A, AA, and AAA. For Level A conformity, all Priority 1 checkpoints are satisfied; for Level AA all Priority 2 checkpoints are satisfied; for Level AAA all Priority 3 checkpoints are satisfied. Conformance levels are cumulative. For example, Level AAA conformance would indicate that a web page conforms to Priority 1, 2, and 3 checkpoints. Web pages can display logos to indicate a claim of conformance to a specified level of conformity with the WCAG 1.0.

The WCAG are formulated around two general web page design strategies: *ensuring graceful transformation* and *making content understandable and navigable*:

3. Ensuring Graceful Transformation. Web surfers may operate in contexts very different from the one in which a web page is developed. Therefore, web pages should transform gracefully. A page transforms gracefully when it remains accessible despite any constraints that may include (though not be limited to) physical, sensory, and cognitive disabilities, work constraints, and technological barriers. For example, a web surfer may not be able to see, hear, move, or use a keyboard or mouse, or may have difficulty reading or comprehending text. The surfer may have a small screen, a slow Internet connection, an early version of a browser, a different browser, a voice browser, or a different operating system. For web pages to transform gracefully, structure must be separate from presentation. Structure refers to the logical organization of a page while presentation refers to how a page is rendered, such as print, computer graphics, text, or synthesized speech. The theme of graceful transformation is addressed primarily by Guidelines 1 to 11.
- Making Content Understandable and Navigable. Web page authors should make page content understandable and navigable. The language of a web page should be clear and simple, but also provide understandable mechanisms for navigating within and between pages. Providing navigation tools and orientation information in web pages maximizes accessibility and usability. Not all surfers can make use of visual clues such as image maps, proportional scroll bars, side-by-side frames, or graphics that guide sighted users with graphical desktop browsers. Web surfers may also lose contextual information when they can only view a portion of a page, either because they are accessing the page one word at a time as with a speech synthesizer or a Braille display, or one section at a time as with a small or magnified display. Without orientation information, users may not be able to understand very large tables, lists, or menus. The theme of making content understandable and navigable is addressed primarily in Guidelines 12 to 14.

## **Designing Accessible Web Pages**

### **Principles of Accessible Web Design**

The WAI has produced an extensive set of guidelines for authoring accessible web pages. Since the Guidelines are a technical document that may be somewhat overwhelming to a beginning web author, the HTML Writers Guild (see [www.hwg.org](http://www.hwg.org)) has proposed six principles of accessible web design upon which the WCAG were written. The following principles are the basic rules for accessible design that formed the specific instances described in each individual entry in the guidelines (Bartlett, 1998):

1. Create pages that conform to accepted standards. Use the W3C recommendations for WCAG, HTML 4.01, and CSS2 for designing web pages.
2. Know the difference between structural and presentation elements. For example, <EM>, <ADDRESS>, and <LI> are structural elements while <B> and <CENTER> are presentation elements. Use HTML structural elements to convey page content and style sheets to convey page presentation and formatting.
3. Use HTML 4.01 features to provide information about the purpose and function of elements. Attributes such as TITLE and CLASS allow the web author to provide additional information on the function and meaning of particular tags, thus increasing the accessibility of the page.
4. Ensure that pages can be navigated by keyboard. For example, using client-side image maps with the ALT tag and ACCESSKEY attribute will accommodate keyboard navigation by a browser agent.
5. Provide alternative or text-based methods to access non-textual content that includes images, scripts, multimedia, tables, forms, and frames for user agents that do not display them.
6. Be careful of common programming techniques that can reduce the accessibility of your site such as ASCII art, blinking text, or adjacent links that are separated by non-printable characters.

## HTML 4.01

HTML 4.01 is W3C's recommendation for the latest version of HTML. HTML 4.01 was released on December 24, 1999, and fixes bugs in the HTML 4.0 specification, which for instance, omitted the name attribute on the IMG and FORM elements. HTML 4.01 defines the semantics and data types for HTML. HTML 4.01 includes mechanisms for style sheets, scripting, embedding objects, improved support for right to left and mixed direction text, and enhancements to forms for improved accessibility for people with disabilities. HTML 4.01 is specified according to three variants:

1. *HTML 4.01 Strict* excludes the presentation attributes and elements that the W3C expects to phase out as support for style sheets matures. Web authors should use the Strict DTD when possible, but may use the Transitional DTD when support for presentation attribute and elements is required.
2. *HTML 4.01 Transitional* includes presentation attributes and elements that W3C expects to phase out as support for style sheets matures. Web authors should use HTML 4.01 Strict when possible, but may use Transitional when support for presentation attributes and elements is required.
3. *HTML 4.01 Frameset* is used for documents with frames. This variant is identical to the HTML 4.01 Transitional except for the content model of the "HTML" element: in frameset documents, the "FRAMESET" element replaces the "BODY" element.

The web author designates which of these variants are used on a web page by inserting a line called a Document Type Definition (DTD) at the beginning of the document. This line is used by the validation service to determine the variant of HTML 4.0 that is used on a page. Each variant has its own DTD. For example, the DTD for a web page that is HTML 4.01 Transitional is:

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">
```

The complete HTML 4.01 specification is available in English in several formats, including HTML, plain text Postscript, and PDF at <http://www.w3.org/TR/1999/REC-html401-19991224>.

## Cascading Style Sheets

Cascading style sheets (CSS) facilitate accessibility to web pages by separating document structure from presentation. CSS2 is the current specification for cascading style sheets and is a recommendation

of the W3C. A discussion of the accessibility features of CSS2 may be found at [www.w3.org:80/TR/CSS-access](http://www.w3.org:80/TR/CSS-access).

Style sheets were designed to allow precise control over page presentation properties such as character spacing, text alignment, object position on the page, audio and speech output, or font characteristics apart from markup. By separating style from content, web authors can simplify the HTML in their documents while making the documents more accessible at the same time. CSS facilitates accessibility in several ways:

- **Tag misuse.** CSS2 allows precise control over spacing, alignment, and positioning, thus, eliminating the practice of misusing a structural element for stylistic effects. For example, the `BLOCKQUOTE` and `TABLE` elements in HTML are intended to mark up quotations and table data, but are frequently used to create visual effects such as indentation and alignment.
- **Image misuse.** CSS2 positioning properties eliminate the need for invisible images to position content.
- **Font control.** CSS2 provides for precise control over font size, color, and style.
- **User override.** CSS2 allows users to override author styles and to view documents with their own preferred fonts, colors, and styles by specifying them in a user style sheet.
- **Orientation and navigation.** CSS2 provides support for automatically generated numbers, markers, and other content that assists surfers in staying oriented within a document. Long lists, tables, or documents are easier to navigate when numbers or other contextual clues are provided in an accessible manner.
- **Aural style sheets.** Aural style sheets are used to specify how a document sounds when rendered as speech. Aural style sheets allow authors and users to specify properties such as the volume of spoken content, background sounds, and spatial properties for sound that can add effects to synthesized speech. These effects correspond with those achieved with styled fonts for visual output.

Style sheets minimally should provide declarations for all structural elements used in the HTML source. Web pages using CSS essentially need to be unadorned or unformatted. To create a web page with CSS, use HTML code with few or no *deprecated* HTML tags. Deprecated tags are HTML tags that are part of the HTML specification but are expected to be phased out of subsequent versions of HTML.

Style declarations can be embedded at the beginning of an HTML document using a `STYLE` tag (e.g., `<STYLE> </STYLE>`) or embedded inside elements in HTML (called inline styles) using a `STYLE` attribute (e.g., `<H1 STYLE="text-align: center">Heading Level One</H1>`). Style sheets external to HTML documents can be linked to these documents. All methods of style declarations can be used in a single web page.

## Validation Services

**BOBBY.** Bobby (<http://www.cast.org/bobby/>) is a web-based tool that analyzes web pages for accessibility according to the WCAG. Bobby is offered as a free public service by the Center for Applied Special Technology (<http://www.cast.org>) to facilitate its mission to expand opportunities for people with disabilities through the innovative uses of computer technology. Although Bobby is an on-line, web-based validation service, Bobby also requires a manual examination of those components of a web page that Bobby cannot examine automatically. Bobby's analysis of accessibility is based on the W3C's Web Content Accessibility Guidelines. The combination of automatic and manual examination of a web page makes Bobby Approved status equivalent to WAI Conformance Level A--that is, all Priority 1 items have passed.

For example, to become Bobby approved, a Web site must:

6. provide text equivalents for all non-text elements (i.e., images, animations, audio, video)
7. provide summaries of graphs and charts
8. ensure that all information conveyed with color is also available without color

9. clearly identify changes in the natural language of a document's text and any text equivalents (e.g., captions) of non-text content
10. organize content logically and clearly
11. provide alternative content for features (e.g., applets or plug-ins) that may not be supported

Bobby also analyzes web pages for compatibility with various browsers. Analysis is based on documentation from browser vendors when available. Bobby automatically checks sites for compatibility with HTML 4.0. For accessibility and tag compatibility with browser specifications other than HTML 4.0, use the Advanced Options of Bobby. Once a web site receives a Bobby Approved rating, it is entitled to use a Bobby Approved icon on its web pages. Additionally, a Bobby approved web site is eligible for listing in the Bobby Approved Database at [http://dev.cast.org/bobby/approved\\_database.cfm](http://dev.cast.org/bobby/approved_database.cfm). This database may draw positive attention to a Web site and help others understand that Web accessibility is an important initiative.

Bobby is only one step in the process of making a site accessible to as many people as possible. CAST recommends that web developers use Bobby as a first step to ensure accessible web page design. Other web-based tools are available to analyze web pages for their conformance to the accessibility guidelines, HTML 4.01, and CSS2:

1. **HTML 4.01.** To validate a web page for HTML 4.0, the page must contain a Document Type Definition (DTD) at the beginning of the page. The validation tool knows which variant of HTML 4.01 is being validated based on the DTD. The HTML validator can be accessed at <http://validator.w3.org/>. The HTML validator provides validation by URL or by uploading HTML into the validator. Web authors can validate the HTML used in the web pages for conformance with the HTML 4.01 recommendation, and web pages that validate can display a logo to identify the conformance claim.
2. **CSS2.** A validator for CSS2 can be downloaded from <http://jigsaw.w3.org/css-validator/> or validated by URL, by entering CSS text into the validator, or by uploading CSS text into the validator. Validating style sheets requires the use of valid HTML. Web authors can validate the style sheets used in the web pages for conformance and style sheets that validate can display a logo to identify the conformance claim

### Validation Procedures

Validation of accessibility is a continuous process. Validation of accessibility should be performed with both automatic tools and manual examination. Validation procedures should be followed even at the earliest stages of web page development where accessibility issues are easier to identify, correct, or avoid. To assist in web page design and validation, the W3C provides a Checklist of Checkpoints for Web Content Accessibility Guidelines 1.0 at <http://www.w3.org/TR/1999/WAI-WEBCONTENT-19990505/full-checklist.html>. A table containing a checklist with the Priority 1 Guidelines is provided at the end of this article.

When developing web pages, the following validation methods will facilitate the development of accessible web pages that conform to the WCAG:

9. Use an automated validation tool and browser validation tool but remember that automated tools do not address all accessibility issues.
10. Validate source syntax (HTML, XML, etc.).
11. Validate style sheets (CSS2, etc.).
12. Test web pages with a text-only browser.
13. Test web pages with multiple graphics browsers and browser versions.
14. Test web pages with browser or screen reader.
15. Test web pages with multiple screen resolutions.
16. Test web pages with spelling and grammar checkers

### A Quick Guide For Developing Accessible Web Pages

The following web page authoring tips provide a quick guide for establishing WAI Level A conformity (see checklist at [www.w3.org/TR/1999/WAI-WEBCONTENT-19990324/full-checklist.html](http://www.w3.org/TR/1999/WAI-WEBCONTENT-19990324/full-checklist.html)) and Bobby Approval of a web page. A more comprehensive discussion of techniques that implement the checkpoints is defined in the WCAG at <http://www.w3.org/TR/WAI-EBCONTENT-TECHS/>. Additionally, The W3C has developed and published a downloadable *Curriculum for Web Content Accessibility Guidelines 1.0* slide set at <http://www.starlingweb.com/wai/wcag/>. Several of the following examples are provided in the example set of this curriculum at <http://www.starlingweb.com/wai/wcag/oversam.htm> (*Chuck Letourneau & Geoff Freed, Copyright © 2000 W3C*).

### Using Images in a Web Page

- Provide client-side image maps instead of server-side image maps except where the regions cannot be defined with an available geometric shape. When using image maps, use the ALT tag for each image and image map link and provide a text version of the links of an image map elsewhere on the web page. For a client-side image map, describe the destination to which each active area will link. For example:

```
<A HREF="../index.html">
  <IMG SRC="../gifs/logo.gif" WIDTH="630" HEIGHT="111" ALIGN="top" border="0"
    naturalsizeflag="3" ALT="Graphic Header Image with Mapped Links to other pages"
    USEMAP="#insideheaderb55d8d01">
    <MAP NAME="logo55d8d01">
      <AREA HREF="newsletter.html" COORDS="534,85,625,108" SHAPE="rect"
        ALT="Link to Newsletter Page">
      <AREA HREF="staff.html" COORDS="462,86,533,108" SHAPE="rect"
        ALT="Link to Staff Page">
      <AREA HREF="syscomp.html" coords="100,85,193,108" SHAPE="rect"
        ALT="Link to System Components Page">
    </MAP>
  </A>
```

- Bitmapped text images cannot be read by a screen reader and should also use the ALT tag. For example,

```
<IMG SRC="wai-lg.gif" ALT="Graphical Link to Web Accessibility Initiative">
```

- Images or buttons with links should be large enough to allow surfers who use an alternate type of pointing device with their computer to easily select the image.

### Using Tables in a Web Page

- Use tables primarily to convey statistical data or organized information. For data tables that have two or more logical levels of row or column headers, use markup to indicate data cells <TD> and header cells <TH>.
- Restrict the use of tables for layout of web pages. Use Cascading Style Sheets to layout and format text and images on a web page instead of tables. If a table is used for formatting text, use the SUMMARY tag. For example:

```
<TABLE width="640" border="0" CELSPACING="0" CELLPADDING="4"
  SUMMARY="This table is for formatting purposes only.">
```

- If tables are used for formatting and placement, test them in a text-only browser such as Lynx to verify that a text-only browser will display your content properly or with a browser reader to determine that the layout of your web page is comprehensible to users of assistive technology.

### Using Frames in a Web Page

- Title each frame in a web page to facilitate frame identification and navigation. For example:

<FRAME SRC="tocleft.html" TITLE="Table of Contents Frame">

- If possible, do not use frames in a web page because frames cause difficulty in printing, viewing, and navigation for all users, not just those with physical disabilities.

#### Using Applets and Scripts in a Web Page

- a. Ensure that pages are usable when scripts, applets, or other programmatic objects are turned off or not supported.
- b. If pages are not usable when turning off applets and scripts, provide equivalent information on an alternative accessible page.

#### Using Multimedia in a Web Page

- Provide an associated auditory description or text transcript and provide a link to the text transcript for the important information of a multimedia presentation.
- Synchronize captions or auditory descriptions of the visual track for any time-based multimedia presentation with the presentation. At present there are three formats or languages that support the ability to synchronize equivalent alternatives. These formats are Apple's QuickTime, the W3C's SMIL (Synchronized Multimedia Integration Language) and Microsoft's SAMI (Synchronized Accessible Multimedia Interchange).
- Interactive content that requires the surfer to press a key should not be time-limited and animations that use text should show the text long enough for a slow reader to read it.

#### Using Alternative Web Pages

1. If it is not possible to create an accessible page, provide a link to an alternative page that uses W3C accessibility technologies, has equivalent information and functionality, and is updated as often as the original page. Because it is difficult to keep alternative pages up to date with the full content of the original page, alternative pages should be provided only after all other pertinent techniques outlined in the WCAG have been attempted. One common way to give surfers a choice is to use the following HTML near the top of an opening page:

Welcome to the Web Accessibility Page!

<A HREF="textversionpath/textversionpage">For a text version of this site, follow this link.</A>

2. Provide an alternative to web form submission such as phone number, fax number, e-mail address, or postal mail address to submit information. Even though a form may be accessible, there may be other ways of filling it out without using the web that are more convenient and less time-consuming for the surfer with disabilities.

#### Using Color and Backgrounds in a Web Page

1. Use adequate contrast between text and background colors as well as colors used in graphics. Dark text against a light background provides the most contrast for people with low vision. Do not use color to convey information unless the information is also clear from the markup and/or content of the displayed text.
2. Avoid using busy patterns or brightly colored background images. Do not tile an image as a background that will distract from the text or make it difficult to distinguish between the background and foreground elements.
3. Make sure your web pages can be viewed on a monochrome or grayscale monitor. A web page that can be viewed in grayscale or monochrome can also be printed without loss of information.

## Using Hyperlinks in a Web Page

- a. Use text for links that make sense when read out of context. For example, a link that says "Click Here" has no meaning out of context. Link text should be descriptive, yet not too long, for it may cause difficulty for screen-enlarging software:

`<A HREF="access.html">Follow this link to the Web Accessibility Page.</A>`,  
displays like this on a web page:

[Follow this link to the Web Accessibility Page.](#)

While HTML code like this:

To go to the Web Accessibility Page, `<A HREF="access.html">click here.</A>`  
displays like this on a web page:

To go to the Web Accessibility Page, [click here.](#)

- b. Insert printable, non-link characters between links that are adjacent, such as an asterisk (\*) or a vertical line (|). Visually impaired users and screen readers may have difficulty distinguishing between links that are separated only by a space.

To display text links like this:

[ [Goals](#) | [Components](#) | [Training Calendar](#) | [Best Practices](#) | [Resource Center](#) | [Staff](#) |  
Newsletter ]

use HTML code like this:

```
[<A HREF="goals.html">Goals</A>  
| <A HREF="syscomp.html">Components</A>  
| <A HREF="training.html">Training Calendar</A>  
| <A HREF="bestdocs.html">Best Practices</A>  
| <A HREF="rescenter.html">Resource Center</A>  
| <A HREF="staff.html">Staff</A>  
| <A HREF="newsletter.html">Newsletter</A>]
```

## Conclusion

As the use of the Web is perceived to be an effective tool for dissemination of research findings or for the provision of asynchronous instruction, the issue of accessibility of web page information will become more and more relevant. The W3C has embraced the issue of accessibility through its Web Accessibility Initiative and essentially thrown open the gates to the virtual kingdom for persons with disabilities. Web accessibility is a design issue and the benefits of developing accessibility features in web pages easily offsets the additional time and labor requirements for authoring accessible web pages. Because of the commitment of the W3C to web accessibility and the availability of resources and tools for web authors to use in the development of accessible web pages, new and experienced web authors have a compelling mandate for including accessibility features in the design of web pages.

## References

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Casey, C. (September, 1999). Accessibility and the educational web site. *Syllabus*, 13(2), 26-30.

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# ONLINE FORUM INSTRUCTIONAL GUIDE

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## Introduction

This guide provides suggestions to faculty using online forum to conduct effective online discussion. This guide was developed in response to the growing number of instructors at Ohio University who are considering or making the transition to using an online conferencing tool for course discussion. Online teaching is becoming a part of the educational culture with its own unique characteristics, which need to be considered in order to be successful.

This instructional guide is based on the experiences of some online teachers and students at Ohio University. While this guide is not a prescription for conducting perfect online discussions, it offers practical information for instructors who want ideas and techniques to teach online more effectively. It is not a user guide, but it is a useful collection of conceptual issues and online instructional tips organized into the following four areas: pedagogical, social, managerial, and technical.

### 1. Pedagogical Aspects:

#### ➤ Instructor as Facilitator

In online teaching the role of the teacher should be transformed from a transmitter to a facilitator, collaborator or moderator. In this role there is a partnership between the faculty and student in which they work together to achieve the course objectives. The following are some suggestions:

#### The Role of the Facilitator:

- ◆ The primary role of the instructor in online teaching is to create a learning environment that motivates the students to construct meanings through interaction with each other as well as with their instructor. The instructor and the student should engage in an active dialog.
- ◆ Online instructors should avoid the authoritative style especially when working with adult learners.
- ◆ It is the responsibility of the facilitator to build the understanding of conversational discussion and to move students away from the debate style, which normally leads to flaming. To do that the instructor needs to encourage students to stick to the subject of a particular line of discussion.

#### What the facilitator should do:

- ◆ In online teaching the facilitator is responsible for keeping discussions on track, contributing special knowledge and insights, weaving together various discussion threads and course components, and maintaining group harmony.
- ◆ To encourage participation the online instructor should introduce various options of learning that stimulate learner participation and interaction.
- ◆ The facilitator should move away from the correspondence model, in which students send in their assignments to the instructor who then sends back their feedback, to a model that would allow dialogue and interaction. The online discussion forum should allow participants' personalities to come across the medium.
- ◆ One of the biggest mistakes that an online facilitator should avoid is to treat the students as children. In fact, in the case of adult participants, some online students may be as knowledgeable

as the facilitator in a specific subject; therefore, the facilitator should utilize this situation by asking such students to share their experience with their classmates.

➤ **Instructor Visibility:**

Instructor visibility is a determinant factor for the success of online discussion. Therefore, every online instructor needs to be aware of different ways and means by which they can increase their visibility in their classes. For example the following are some different type of messages that online instructors can send to increase their visibility.

- Content-related messages (i.e. handouts, discussion questions, notes).
- Rules and Guidelines (i.e. grading procedures)
- Technical tips (Internet addresses, information about how to send an image as an attachment, information of how to paste text or image).
- Responses (answers to students questions, feedback).
- Announcements (projects and assignments due dates, information about guest speakers).

The instructor can be visible by modeling a high level of participation, which often encourages the students to enhance their own participation. The instructor who shows low visibility in online discussion normally gives students an excuse to reduce their participation, or even not to show up. They assume that their instructor will not grade them down because he/she is behaving in the same way. Another reason that makes instructor visibility crucial in online discussion is to minimize the sense of isolation that distant students normally encounter. Students feel secure, connected and as if they are working in a collaborative environment with other students and with their instructor if they find a number of new messages in the forum. Instructor visibility provides distant students with a sense of belonging to a body that supplements the traditional classroom. If for any reason the instructor has to be absent he/she should notify the student as soon as possible and look for other ways of communication since the online discussion continues beyond class meeting time. (See Figure F1 for an example).

Figure F1

Hi Everyone,

I wanted to let you know that I will be out of town Wed - Sunday. I should have email access most of that time and do plan to check my email daily except Wed and Sunday. I will likely not be checking ACT until I return.

Please allow a couple days for me to reply to your emails, though - just in case there are technical problems.

I will be in my office the rest of today - so you can email me until 5ish today without any problems.

I hope this doesn't cause any major problems.

Chandra

➤ **Feedback:**

- ◆ Timely feedback assures students that their instructor is focusing on them and following what they are doing. On the other hand, delayed feedback leads students to think that their instructor is not involved enough in their learning process. Therefore, instructors should expect to communicate regularly and frequently with students.

**Diplomatic** feedback is motivational and will encourage students to be enthusiastic and confident that they will succeed online. When the instructor wants to write **critical** feedback it is crucial for him/her to send a well-worded email message that preserves student dignity and prevents embarrassment. **Warm** feedback indicates that the instructor understands and remembers that it is

people who are engaging in communication and not software. However, if a student proves to be disturbing to the online discussion he or she should receive a positive but clear message indicating that the conduct is not appropriate. Figure F2 is an example of an effective, critical and diplomatic feedback that conveys to students that their instructor is interested in their contributions.

Figure F2

Ismail,

This is a very well thought out response. I really like that you point out the importance of the attitudes – if the learners are not ready or do not see the importance of this training, that is a critical non-instructional barrier to learning.

I find it interesting that you don't ask any questions in the needs analysis to determine if there are other ways than just inservice days to support this effort.

I do like that you suggest really exploring the goal of technology literacy as that may have very different definitions from different parties. (The principal may think something very different from the teachers and the ID team may have a completely different idea.)

Chandra

#### ➤ Online Materials

Although the online instructor's role is basically to facilitate, he/she also should provide relevant materials to enhance the learning process. As with the student discussion, the materials need to be focused on the coursework. To help make material relevant, Instructors should develop questions and activities for learners that relate to the students' experiences. After instructors have the biographical information of their students they may be able to include material that would appeal to the learning interest of their students.

It should be made clear whether posted material is mandatory or optional so that students may manage their time and prepare for responses. Posting online material such as Mini-lectures and handouts requires careful editing since they should enhance the face-to-face lectures rather than offer a replacement. Also, all postings should be checked for accuracy regularly. Students will become frustrated with the instructor who posts a website address that is no longer there.

Be sure to edit all online course materials for correct information. All online documents should be clear and detailed, as well as containing a full description of what is required from students and the due dates of these requirements. The instructor should have class materials uploaded and tested 2-3 days before the day in which students have to check it.

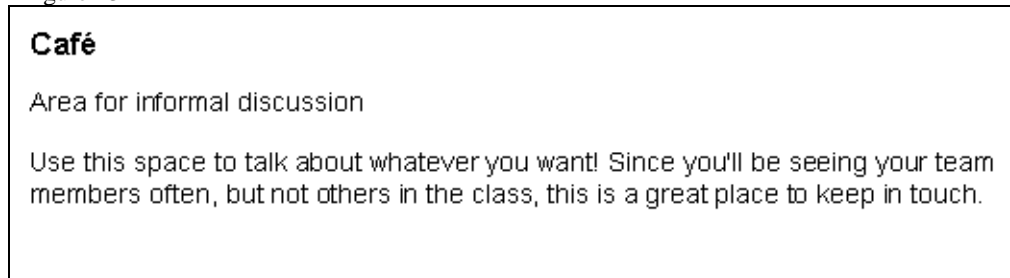
## 2. Social Aspects:

Online education should be looked upon as a social construct where learning is supported by technology.

- ◆ To help build a sense of community and reduce the feeling of isolation, the facilitator should encourage students to post their biographical information in the first online activity.
- ◆ Interpersonal-communication techniques are particularly important in an online environment where there are fewer verbal and physical cues to help smooth dialogue.
- ◆ The energy and personality of an online instructor can also be effectively communicated through the warmth he/she brings to the forum. Many online facilitators believe that increasing warmth online is a way to reduce the psychic distance among the forum participants.

- ◆ Another way to bring warmth to the forum is by treating students uniquely by identifying them by their names.
- ◆ Creating a friendly, social environment that promotes learning essential for the success of an online forum. Promoting collaborative work, and providing the opportunity for other interactions through the development of a café where students are free to discuss intellectual and personal matters on their own can achieve this goal.

Figure F3



### 3. Managerial Aspects:

Managing an online conference can be time consuming and labor-intensive, therefore, instructors who want to use online discussion for the first time should be aware and prepared to accept the challenge. Once the discussion starts students can create many messages that could overwhelm the instructor. The following suggestions may help you avoid common pitfalls.

#### ➤ **Organizational:**

- ◆ Putting together an organized syllabus that establishes guidelines and provides students with clear and detailed information can save online instructors a lot of time and effort. The syllabus should state in detail what is expected when students have to give feedback to the class. It may be useful to provide both the week and the due date for assignments rather than just writing “the feedback is due on Monday.”
- ◆ Novice online instructors often underestimate the time and effort required for planning, developing and putting together online course materials. Many online instructors emphasize that lead-time to prepare an online course is substantially greater than they anticipated. Therefore, careful planning is essential.
- ◆ A classroom with 20 students or more will likely generate a huge number of messages in a short time. Breaking the class into small groups with 5-7 students will ease the management issues. Furthermore, it will encourage more interactions among students by keeping the number of messages smaller and the discussion more on track.
- ◆ For organizational purposes instructors may create an area in which they can post announcements, contact information, office hours, and links to related web sites. The idea announcement can be seen in Figure M4.

Figure M4



➤ **Procedural:**

- ◆ Depending on the objectives of the online conference the instructor may decide to encourage informality in discussion. For example, the instructor may decide to let participants know that perfect grammar and typing is less important than making their ideas and arguments clear.
- ◆ It is recommended that the instructor respond to students' postings within 72 hours. The instructor may not send feedback to every student, however he/she can respond to several students at once by weaving their contributions together or summarizing the discussion.
- ◆ The policy of participation should be clearly stated in the syllabus. Both the importance of participation to the learning experience, as well as how participation will contribute to the student grade, should be emphasized. The instructor also needs to address in the syllabus the issue of late assignments and how he/she will handle them.
- ◆ To ensure thoughtful active discussions, students should be graded on their participation in them. This grade should be at least 20-25% of the total grade for the course.

➤ **Administrative:**

- ◆ When a discussion thread or a conference has served its purpose the instructor should be decisive in ending it.
- ◆ Students can be given an opportunity to lead, moderate, or assist in directing the discussion. The instructor may ask students to take turns to experience administration responsibility.
- ◆ In any online conference there are two extreme cases: an active participant who appears above the class level and an invisible member who contributes little to the discussion. The instructor needs to privately contact these members to ask the first to wait a few responses before contributing (see example M1) and to ask the second to participate more actively (see example M2).

**M1**

**Overachiever**

Mary, I like your thoughtful and critical reflections for the discussion topics. My only concern that your classmates are left behind and they have little to add to the discussion. I'd appreciate if you'd slow down a little bit so that your classmates can give it a shot. Thanks

**M2**

**Lurker**

John, I am a little bit worried about your contribution to the discussion forum. You have only posted one message in the last two weeks. Is there any problem that is holding you back from the class discussion. You need to move forward and to catch up with the group. Just remember that 25% of your grade comes from your participation in the discussion. Thanks.

- ◆ Conflict may erupt in online discussion, especially when the topic of the discussion is somewhat controversial. In many cases that can lead to “flaming”. These remarks are not productive and may destroy the discussion. To guard against conflicts instructors need to set up norms and rules for the online conference that lay the foundation for a conflict management strategy. For example, the instructor can set a rule at the beginning of the conference to asking students to respect all opinions and not impose their views on others.

#### **4. Technical Aspects:**

In an online environment, problems related to hardware and software will likely arise. So, while remaining focused on the learning process, the online instructor must develop a working understanding of the technology s/he is using.

- ◆ The instructor should provide students with a user guide or website for the online conference that addresses both the content and the common technical problems. Novice users need time so that they can be comfortable with the technology. Therefore, the instructor should give students adequate time to learn the system before they participate
- ◆ Before starting an online conference instructors need to acquire the appropriate training in configuring, manipulating, and managing the conference. A step-by-step, face-to-face tutorial for novice computer conference administrator is recommended. The instructor should be aware of who is available for technical support beyond his/her technical skill. Contact information about the technical support personnel should be made available to students in the syllabus.
- ◆ Using a graduate or teaching assistant who has technical skill is important for the success of the conference. Graduate or teaching assistants can help with technical issues, as well as sharing administrative and teaching load. For example, a teaching assistant can reply to many technical questions or send feedback related to the discussion, or even step in to direct the discussion in the instance of the instructor’s absence.

#### **For more information**

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## CONTEXTUAL CONSIDERATIONS FOR TEACHING ONLINE AT THE POSTSECONDARY LEVEL

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*Designing an online class guided by principals of learner-centered instruction at the postsecondary level is a daunting challenge for new professors facing the demands of a tenure track position. The case study identified challenges faced by a new professor teaching an online course. This study found an online environment presents challenges unique to the technology and recommends that university administrators must recognize such challenges in order to encourage pedagogically sound online instruction.*

### The Study's Purpose

This paper presents the findings of a pilot project on two junior faculty's experiences with online course development and teaching in a university setting. The study's purpose was to identify contextual issues faced by new, untenured university faculty. Often junior professors are learning to teach in the face-to-face environment as well as learning to teach in the relatively new online environment. Additionally, the current emphasis on integrating technology into postsecondary teaching practices as evidenced by the Pew Symposia in Learning and Technology (<http://www.center.rpi.edu/PewSym1.html>) and the academic reward system as evidenced by the tenure process can mean that new faculty often encounter overlapping and or competing demands on their time and efforts as they seek success in meeting these two challenges. This study was designed to identify and describe the contextual experiences of junior faculty as they developed and taught online courses. The study's purpose was to identify and to describe those experiences in ways that would be useful to academic administrators, and in ways that would provide a robust basis for conducting a larger descriptive study.

The researchers designed a qualitative case study examining two professors who were in the mid stages of the tenure process, who had experience teaching courses online and face-to-face, and who facilitated active, meaningful learning that can be termed learner-centered instruction according to Branch (1995) and McCombs and Whisler (1997). The researchers' primary purposes were:

- To clarify contextual issues that affect a professor's ability to successfully integrate online teaching technologies into instructional practices that support active and meaningful learning
- To describe the professors' perceptions and experiences in online teaching

The researchers' secondary purposes were:

- To identify any additional data sources that would provide a fuller description of this study's area of interest
- To develop useful questions in order to construct a larger study that will continue to further define critical issues

### Research Method

#### Qualitative Case Study

##### Participant Selection

The research design selected for this study is a qualitative case study following the guidelines for a case study as explained by Merriam (1998). The case is bounded by the area of interest, the focus of the research questions, and by the selection of the participants. Based upon LeCompte and Preissle's (1993) recommendations for participant selection, selection criteria were established. The two participants selected for the study met the following qualities, they:

- Valued and followed good teaching practices as described by Chickering and Gamson (1987) and McCombs and Whisler (1997).
- Were in a tenure track position and were in the process of going for tenure

- Were developing their experience in teaching with online technologies
- Had a personal interest in becoming better at teaching with online technologies
- Were teaching at two large universities that have officially adopted a course management software
- Were teaching an online class in two different disciplines
- Represented the use of two different brands of online course software

The two participants agreed to participate in the pilot study because they had a personal interest in the topic. When the data were collected and transcribed, the researchers assigned pseudonyms to the two participants. The transcribed interviews were returned to the participants. The participants have not yet seen the completed analysis.

### **Data Collection**

One tape-recorded interview was conducted with each participant. The interviews were open ended and guided by the suggestions of Kvale (1996). The researcher let the interview process guide the questions rather than following a question guide. Each interview lasted until the interviewer and the participant sensed that the discussion and questions were exhausted. Each interview lasted approximately one hour. The interviews were fully transcribed and the analysis made from the transcriptions.

### **Data Analysis**

The first author read through the transcribed interviews, took notes in the margin and underlined sentences or phrases that appeared to describe each participant's experiences. This process resembled the coarse coding described by Merriam (1998). During a second reading of the transcribed data, the first author began constructing three charts that displayed and summarized the categories of data. One chart (Figure A) displayed information describing the participants in their setting. The second chart (Figure B) displayed the similarities between the two participants. The third chart (Figure C) displayed the differences between each of the two participants' experiences.

As the first author created the charts, she also began to create a list of categories pulled from the transcriptions. This list was kept on a lined notepad beside the transcribed pages. This list of categories became the basis for analyzing, refining, and representing the data in ways that would meet the purpose of the study and answer the research questions. These categories were then re-analyzed and combined according to their supporting data units.

### **Self-disclosure of the researchers**

The two researchers were drawn to designing a study to explore this issue because they have had personal experience with creating and teaching online courses for university students. Their personal experience facilitated their perception that a professor's experiences when designing and teaching an online course were different than the experiences when designing and teaching a similar face-to-face class. Because the two researchers are not tenured faculty, they became aware that the demands of the tenure process seem neither to reflect nor to recognize the differences between teaching in a face-to-face class and teaching in an online class. Thus, the two researchers had a personal interest in developing a research study that would identify and describe the contextual considerations new professors face when teaching an online course. The two researchers knew one another from being classmates in a Ph.D. program at the University of Georgia.

### **The Research Questions**

- How do the professors describe the experience of planning and teaching an online course?
- How do the professors perceive the demands of teaching a class online compare with the demands of teaching a similar class face-to-face?
- How do the professors understand the context of online course development and teaching?

### **Representing the Data**

The two professors

The two professors in this study, Professor Eden and Professor Simpson, teach at major universities in the United States. Professor Eden is teaching in a college of education at a Carnegie ranked Research I University; Professor Simpson is teaching in a college of hotel administration at a



doctoral granting university. Both professors are teaching required courses in their respective colleges. They are each using a well-known brand of online course software. During the period of this study, both professors were teaching online courses for the second time, and both were confronting the demands of the tenure process.

Both professors were technologically fluent in that they had created web pages for their courses prior to using the online course software, and both had originally started making pages by hand coding with HTML. Both professors valued active learning for their students and sought to use strategies that would facilitate meaningful knowledge construction. Although the professors did not use the term *learner-centered* to describe their approach to teaching and learning, they both described their concerns and teaching strategies in ways that meshed with Branch (1995) and McCombs and Whisler's (1997) description of learner-centered.

Professor	University	College	Course	Class Size	Students	Software
Eden	Primarily residential, Research Level I	College of Education	Educational Technology  Required	15	Graduate  In-service Teachers	Blackboard
Simpson	Urban, commuter campus, Doctoral granting	College of Hotel Administration	Human Resources  Required	12	Undergraduate  Working in hospitality	WebCT

Figure A. Chart displaying information describing the participants in their setting

The students in both classes were working in fields related to the course. Professor Eden's students were predominantly K-12 school teachers. Many were enrolled in the masters program because they wanted to advance to a higher pay level. Professor Simpson required the students to be working at least part time in the hospitality industry as a pre-requisite for enrolling in the class, and gave the students assignments that required the students to interact with the human resources personnel in that industry. The students in both professors' courses could choose to take the course online or in a face-to-face classroom environment.

Both professors wanted to be better at teaching. Professor Simpson stated,

To get tenure you need to be able to teach at a standard that's acceptable to the university, and that standard is not acceptable to me. I needed to push myself to learn how to teach. So, I took a certification class, it's called a certified hospitality educator, which was a week long class.

Professor	Technology fluency	Online software	Teaching goals	Importance of feedback	Course development
Eden	Created their own resource rich web pages when teaching a prior class.	Had to spend time on their own to learn to use the university online courseware	Wanted to be better teachers than what their administrators suggested was acceptable	Believed students need good feedback in order to learn.	Learned about teaching online from the students' feedback, interactions and assignments.
Simpson					

Figure B. Chart displaying similarities between the two participants

Both professors believed that their online courses had to be more than just reading and completing the assignments. Professor Eden explained,

How are you really going to get them to think? . . . I mean if all I had to do was pick up a book and read materials, then I guess universities are not really necessary . . . So, I mean just

having a web site with your information on there, and having those discussion boards is not doing it. Because the discussion boards are hard to manage, people are not reading everything, and you're not really getting the interaction between the students that you want

Neither Professor Eden nor Professors Simpson had definitive answers to the challenges they were encountering as they developed their online courses. They were both actively learning as they went along. Both professors were learning from their students.

The two professors differed in some of the online software usage and in the ways they were encouraged to teach an online course. Professor Simpson was given release time from the department chair to develop the course. The professor considered online learning to be of growing importance to the hospitality field. The department let the class "go" even though its enrollment of 12 was less than the required number for running a course.

Professor Eden felt somewhat pushed into teaching an online course because the administration wanted to get more of the curriculum online. She was worried that the course would not be appropriate for online learning. "I didn't think the class was appropriate because it was team based, and I don't care if you do e-mail, you still want to meet face-to-face in a team kind of thing."

The two professors experienced differences in the way that their universities marketed the online classes. Professor Eden's university promotes online courses and online programs on the web site by appealing to people who don't have sufficient time to take a class. Professor Eden explained,

The way that it markets is probably the reason why we have the attitude problem of our students. The web site says, 'You don't have time to take a class? You don't have time for class?' So, what does that mean? . . . Which means that you don't have time to do all the work that goes with the class, then take web based classes.

Eden	Advised to get the course up and it will run itself	Misleading marketing	Has used more than one course software	Teaches using team projects	Students reported confusion understanding organization of courseware interface
Simpson	Administration gave release time to develop course	Lack of informative marketing	Knows only WebCT	Teaches with individual projects	Students did not report interface confusion

*Figure B. Chart displaying differences between the two participants' experiences*

In contrast, Professor Simpson's university does very little marketing of the online courses and has no online programs. Professor Simpson attributes some of the class's low enrollment to a lack of marketing. "I don't know what distance ed said to them over there. The two flyers that I saw were not acceptable to me to find out information, and so I will be creating my own marketing this year for fall semester."

Because Professor Eden's students were taking courses at the university that were presented with different course software, and because part of their course included designing websites, they expressed their confusion about finding how professors' organized their online courses. "People organize information differently. So, I might put my assignment in *Assignments*. Some people put all their assignments in *Course Documents* . . . Where do the students look for just this document to help them do something?"

### **Summary**

Although the professors had many differences between their institutions and their fields of study, both professors shared a strong belief in active learning and learner-centered instruction. Both professors were motivated by a desire to create a positive and meaningful learning experience for their students. Both professors needed interaction and feedback from their students in order to gauge the

progress of their students' knowledge development. Both professors created projects or assignments in their online class to help their students learn and to enable the professors to understand how the students were progressing.

## **Findings in Response to the Research Questions**

### *How do the professors describe the experience of planning and teaching an online course?*

The two professors found their time management and preparation skills differ when they teach in an online environment. Both professors were learning to develop their online teaching and course development skills. The two professors discussed changes in their thinking as a result of developing and teaching online. Professor Simpson reported that the experience of both taking an online course and creating an online course caused her to think differently about learning. She explained, "I'll talk with my students about where do they learn best. And if they say, 'I learn the best curled up on my couch.' OK. Can you get you computer there?"

For Professor Eden, the online course caused her to rethink her frequency of online responses as it related to the students' ability to manage themselves..

The first time I taught, I tried to respond to every other message . . . I started letting them control as far as like responding to each other. And I would add something in if I felt they were off target or getting out of hand, you know a little bickering and so forth . . . But I felt I was taking up too much time trying to make sure they were doing what they needed to do.

### *How do the professors perceive the demands of teaching a class online compare with the demands of teaching a similar class face-to-face?*

Both professors remarked about the different time expenditure between an online course and a face-to-face class. Professor Eden stated,

It's much more work than face-to-face. You definitely have to be more prepared, far more in advance. A lot of time when I was doing face-to-face I'd think, I want to change that a little bit because of the way they reacted maybe the week before and I could prepare the night before.

Professor Simpson was even more specific in the time differences.

I logged an average of six hours a week in WebCT in my class which is more than I ever put in on class time. . . . So, maybe four and a half hours max a week in a face-to-face class that I may teach two sections of versus six hours a week in an online course. And that's not counting the grading and inputting. I knew what it took to grade a project that I taught in a face-to-face class. That same project or some elements of the project to grade in an online class, write up the results, post the results, do follow-up, adds twice the amount of time.

### *How do the professors understand the context of online course development and teaching?*

Both Professor Eden and Professors Simpson felt that the university administration did not have a realistic understanding of the time demands and demands for self-teaching that an online course required. Both professors had to spend time and energy figuring out the technology and the pedagogy of online teaching for themselves.

Both professors were strongly encouraged by their college administrators to use online course software although the quality of their support varied. Both professors knew that university administrators anticipated being able to teach larger classes with online technologies, and both professors expressed concern for the quality and course management of classes with larger enrollments than 25 or 30 students.

Teaching an online course forced the professors to confront the technology and the software. Professor Simpson designed elements into the course, such as audio clips or animated gifs, in order to check capability of the students' computers. "Throughout the course, I kept checking with the students to make sure they still had computers at home. And two students either lost their computers because they moved and it was the room mate's computer, or the computer failed on them."

## **Discussion of the Findings**

### **Interaction**

In the context of teaching their online courses, interaction became an important concept. Interaction infused both professors' thinking. The professors sought to create interactions on many levels. The interaction between the professors and the students and the course content and the students' work experiences and the technology was complex and was an important part of the professors' thinking about their online courses. The professors encouraged interaction between the students and the course content. The students in both professors classes were working in the field of study, and the two professors deliberately structured their courses in ways that would make the course content interact with the students' work life experiences.

The professor interacted with the students and learned from their students' interactions. Through the students' interaction, the professors learned how well the students were progressing in their knowledge development as well as how effective the technology and course organization was. In sum, the professors learned about how to create, organize, and teach their online courses from interactions with their students.

### **The Importance of the Students Expectations**

The two professors' online teaching experiences were very influenced by the students' expectations. The students' expectations, as described by the two professors, were related to their reasons for taking the courses and the university's conceptualization of online learning as manifested through their outreach marketing. Professors Eden's students were primarily working K-12 teachers whose motivation for earning a graduate degree was to move into a higher pay grade level in their school systems. The university marketed the online learning program by implying that online learning was easier and required less time than coming to the campus to attend classes. The university's marketing efforts influenced the students' expectations that the course would make it easier for them to manage their time.

### **Tenure considerations**

There were differences between the pressures the two professors experienced in regard to tenure documentation. Professor Simpson considered her field more applied than theoretical. Although there was pressure to achieve excellence in at least one of the categories, achieving excellence in the teaching category was sufficient to carry the lack of an excellence rating in the research category. However, this put even more pressure on ensuring a good rapport and evaluation from the students in the online course. Professor Eden faced greater pressure to publish and conduct research.

## **Implications and Recommendations**

### **Implications for university administrators based upon the study**

- Universities must provide more specific training support for professors using online technologies.
- Online courses are not a time saver for faculty.
- Universities must be critical about the way online courses are marketed to potential students

### **Recommendations for further study**

The findings in this pilot study have served to illuminate the areas that need further data collection in order to design a more robust study.

- Further interviews and data needs to be collected to explain why the university administration is urging new professors to teach courses using online technologies.
- Further interviews and data need to be collected from more professors in order to exhaust all the questions that were raised in this pilot study
- A fuller search of the literature related to the context of online teaching needs to be developed.

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## A COMPETITION TO PROMOTE THE DESIGN OF EDUCATIONAL SOFTWARE

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We established the University of Minnesota Learning Software Awards as a mechanism to identify and promote exemplary and innovative educational software. Our long-term goal is to establish an electronic forum featuring best practices in the field. We want to influence educational design by providing access to samples of work judged to be exceptional, and to create a form of eJournal that publishes active samples of exemplary practice-in-action, not simply written articles.

One criticism of our field is that we have not identified what we consider to be exemplary projects. Although many design professions have well established and easily accessible archives of their best work (e.g. art galleries, buildings, and books), the field of Instructional Technology has done little to establish resources where students or practicing designers can examine the best and most inspirational works.

During the fall of 1999 and spring of 2000, we solicited and received approximately 65 entries from across the United States. Judging involved a two-phase process. First, a pool of 35 judges screened entries. Twenty entries were forwarded for further consideration. Three expert judges conducted final judging: Tom Duffy (UNext), Lloyd Rieber (University of Georgia), and Stan Trollip (Capella University). The judges selected the following award winners and honorable mentions.

### First place awards

The Writing Trek by Sunburst Communications  
Math Problem Solving by Plato Education  
Psychology Experiments by Kenneth McGraw, University of Mississippi  
Off the Wall by Michael Gardner, University of Georgia

### Runners-up

Research Assistant by Dan Schuch, Florida State University  
Tuberculosis Case Management by University Research Co.

### Honorable mentions

Claymation by Mary Beth Kiser, Edina Public Schools, MN  
Probability Explorer by Hollylynn Stohl Drier, University of Virginia  
Bohr's Atomic Model by Jeff Wilden, Weber State University

Although it was beyond the scope of the competition to provide full-access to the projects, all the winners provided resources that can be accessed and examined. Samples representing their projects are available at the competition website: <http://design.umn.edu/learningcompetition> In addition, each of the winners has submitted an article for a special issue of Tech Trends outlining the problems they addressed in their projects and commenting on how they designed their solutions.

Our primary goal was to support the development of innovative uses of technology. We focused on three dimensions of innovation for this competition. The first dimension involves using new capabilities of technology for educational advantage. For example, the very scale and accessibility of the Internet is used to the advantage of researchers and students alike through Psychology Experiments by Kenneth McGraw. There, the power of the Internet connects researchers and research subjects, and provides educational examples for study. Off the Wall by Michael Gardner uses the interactive capabilities of multimedia to investigate the artist Chuck Close. Users explore the work of the artist, interacting with elements of scale, brush stroke and subject. Jeff Wilden describes an interactive multimedia program titled Bohr's Atomic Model. This web-based interactive simulation allows students to build an atom using an atomic construction set.

The second dimension involves solving existing problems in a new or unusual way. Plato's Math Problem Solver and Sunburst's Writing Trek use unique capabilities of the computer and the Internet to assist learners while providing diverse and challenging learning environments. Plato's Math Problem Solving software uses real-world math problems and employs three levels of scaffolded support to guide the user through the solution process. Writing Trek includes a great variety of writing activities and provides the opportunity to publish student work on an Internet site. In contrast to these commercially developed products, Dan Schuch created Research Assistant, a database, to support the complex cognitive demands of graduate education. Not all winners were fully computer-based. Mary Beth Kiser's fifth grade class completed a learning activity involving clay, video, and the World Wide Web.

The third dimension includes new, under-addressed, or under-served problems. Tuberculosis Case Management by Elisa Knebel and Probability Explorer by Hollylynne Drier use the capabilities of the computer in this manner. Tuberculosis Case Management helps medical workers in the Third World, far from Silicon Valley, diagnose and treat a deadly disease. Probability Explorer is oriented to younger students. It engages children through probability experiments and exploration, and allows them to construct a more accurate understanding of the nature of chance.

Our observations from the competition provide insight into the development of educational software. First, it is clear from the descriptions presented by the award winners that the design processes employed varied greatly across the projects. Some groups followed formal methodologies, and in some cases, the strategies employed are the result of a formal design process. In other cases, however, the innovation appears centered on the overlap between expertise in the subject matter and a use or interest in a technology. Often, creative inspiration appears to occur as sudden insight.

Second, access to development funds did not limit creativity. As noted above, three winners were graduate students. Apparently, innovation does not require large teams or budgets. Third, comments from the competition judges about the value of the judging process were overwhelmingly positive. Many people commented that the process of reviewing competition entries was enlightening and worthwhile.

*The competition was funded by the Design Institute at the University of Minnesota. The second round of the competition is currently being planned. Information about the competition, including a video and samples of this year's winning entries, can be accessed at the competition website.*

# THE PARADOX OF CONSTRUCTIVIST INSTRUCTION: A COMMUNICATIVE CONSTRUCTIVIST PERSPECTIVE

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## *Abstract*

With the advent of Constructivist oriented instruction in learning institutions comes an enormous challenge, that of structuring individual-centered learning within a community of learners. Within this instructional framework, struggles to satisfy both individual and group learning needs can lead to one canceling the other out. Tendencies towards either individual-centered or collaborative learning depend largely on the Constructivist stance adopted (Cunningham, 1991, Garrison, 1998; Jonassen, 1991, 1995; Lave & Wenger, 1991; Vygotsky, 1987). This ongoing struggle represents the paradox of Constructivist instruction; however, there is an alternative. This exploratory paper utilizes assumption from Internal Realism (Putnam, 1991, 1994) draws from advances in cybernetic science (Maturana & Varela, 1980; Varela, 1981) and communications theory (Habermas, 1990; Krippendorff, 1994) to make the case that underlying biological and communicative structuring play an important constitutive role in multiple levels of meaning construction (biological, psychological, social) that are implicated in learning processes. The extent to which knowledge of underlying structures can inform on learning processes is addressed and recommendations are made for adopting Communicative Constructivist Perspective (CCP) as a potential educational reform tool for increasing awareness of instruction that may detract from efforts to achieve sustainable learning within a community of learners.

## **I. Assumption**

This exploratory paper revolves around a conceptualization of the subject-object distinction held by a variation of realist philosophy that emphasizes the importance of human practices. This position is commonly referred to as 'internal realism.' Internal realists take into consideration scientific and everyday practices while utilizing subject-object conceptual distinctions to deal with conflicting knowledge claims in order to achieve rational consensus in a changing world (Putnam, 1994).

## **II. Defining subject-object conceptual distinctions**

Why is it important to educational research and instructional design to address philosophical issues such as subjectivity and objectivity? Eisner & Peskin (1990) provide this answer: Thoughts have consequences: how we think about subjectivity and objectivity affects research procedure because these issues are typically embedded in the broader framework, albeit most often implicitly, that directs the conduct of our inquiry (p. 15).

Careful attention must be given when discussing the notion of objectivity and subject-object distinctions, since the terms can have strikingly different connotations depending on how they are being used and to what they refer. The subject-object distinction has ontological, epistemological, and methodological defining levels, along with relations between these defining levels. The ontological level deals with assumptions of what is known or knowable about reality and its nature. The epistemological level address the relationship between the knower and the known where assumptions concerning this relation depend largely on the ontological features supported. The methodological level deals with how one goes about finding things out, the process of which depends largely on ontological and epistemological features supported (Guba, 1990).

The internal realist position utilizes a specific formulation of the subject-object distinction which respect to the features at each level of the subject-object distinction described. First, in terms of ontology,



there is no truth claim to any absolute knowledge that subjects have of objects in the world as the Postpositivist/Realist position holds. Instead, objectivity becomes a regulative ideal. Popper's (1968) states:

The status of truth in the objective sense, as correspondence to the facts and its role as a regulative principle, may be compared that of a mountain peak, which is permanently, or almost permanently, wrapped in clouds. The climber may not merely have difficulty getting there, because he may be unable to distinguish, in the clouds, between the main summit and some subsidiary peak. Yet this does not affect the objective existence of the summit. . . The very idea of error, or of doubt. . . implies the idea of an objective truth, which we may fail to reach (p. 226).

Under Popper's reading of science, what is considered to be objectively true extends beyond what is empirically found and with it scientific inquiry entails more than compiling an inventory of cold hard empirical facts. This interpretation of the fundamental aims of science relocates the focus of objective truth from objective facts to a larger landscape of scientific inquiry more congruent with the extensive range of possible human experience under investigation.

This has an important consequence for education's use of scientific methodology. It suggests what we already know to be true, there is a lot more going on in the realm of experience at any given time than scientific inquiry is able to discern and that trying to maintain an awareness of the expansive landscape of experience leaves the door open to discovering new things in the study of learning processes that are continually immersing in lives. Closing the door on what is not immediately distinguishable is the mark of an impatient scientist.

Second, in terms of epistemological features, the denial of the conceptual independence of subject and object is not a denial of the possibility of human subjects achieving true knowledge about what is objectively there in actuality. Putnam (1987) states, "Kant's glory in my eyes, is to say that the very fact that we cannot separate our own conceptual contribution from what is 'objectively there' is not a disaster." The fact that individuals' experiences take place in the world and within social/cultural communities does not in any way detract from the actual distinction that exists between the subject experiencing and the object experienced.

Third, in terms of methodological features, the individuals' within society constitute a community of critical inquirers. Popper expresses this well when describing the critical spirit of objectivity applied to science: The objectivity of science is not a matter of the individual scientists but rather the social result of their mutual criticism, of the friendly-hostile division of labour among scientists, of their co-operation and also of their competition. For this reason, it depends in part, upon a number of social and political circumstances which criticism possible. (p. 95).

The subject-object conceptual position of the internal realist is to be distinguished from one commonly discussed within the area of Constructivist instruction. In the case of Constructivist instructional theory, most Constructivists accept only one subject-object distinction, that which is part of an epistemological belief system within the subject's experience. Constructivists generally oppose making the ontological subject-object distinction, interpreting this view as being part of an Objectivist stance, to be distinguished from an Constructivist view which does not commit to such a claim (Guba, 1990; Jonassen, 1991). To illustrate:

Table 1: Positions on subject-object conceptual distinctions

Domain	Postpositivism	Constructivism	Alternative
Ontology	Realist *	Relativist	Internal realist *
Epistemology	Objective *	Consensual/subjective *	Critical perspective *
Methodology	Verificatory	Hermeneutical reconstructive,	Rational Communication *

\* upholds subject-object distinction

Upholding a commitment to ontological, epistemological, and methodological varieties of the object-subject distinction establishes a standard that Constructivist instructional theories have tended to conflate (Bopry, 1999; Cunningham, 1991; Cobb & Yackel, 1996; Jonassen, 1991).

### **III. What Constructivism in education is not**

Constructivism is not a type of learning, nor is it a teaching methodology. It is not to be taken as some learning strategy that can be applied one day in a specific context and then forgotten. Rather, Constructivism can be categorized as a philosophy of learning that refers to how individuals learn all the time. That is, individuals constantly construct their learning, whether they are actively pursuing some form of discovery learning or sitting in a classroom taking notes.

However, there are different types of learning construction (Clemens, 1997; Devries & Zan, 1996; Johnson, 1998) for different levels of meaning construction (Bunge, 1979, Gabora, 1997, Luhman, 1986). Some learning processes will be more individually centered and some more group oriented. In addition, not all learning processes will occur at the same level of individual awareness or self-consciousness (Damasio, 1999; Dennett, 1991). There is no one way that has succeeded in explaining the many types of learning constructions adequate to provide a comprehensive picture the Constructivist learning taking place.

### **IV. Statement of problem**

It is argued that the conflation of the ontological subject-object conceptual distinction has narrowed the range of what the epistemological and methodological subject-object conceptual distinctions refers. It is this narrowing of the range of inquiry that is believed responsible for conflicts in how instructional designers conceptualize group and individual oriented instruction , giving rise to an ongoing struggle referred to here as the paradox of Constructivist instruction.

### **V. Objectives**

The paper draws on contemporary work in neuroscience, cybernetics, communications theory, and philosophy of science in order to develop a Communicative Constructivist Perspective (CCP) within a framework that suggests the complementarity and parallel duality (independent yet integrated) of Constructivist learning processes and knowledge.

### **VI. Constructivist learning processes**

One way to view the Constructivist learning is to describe it in terms of processes that make it up and that vary in level of conscious awareness. This is an important component of Constructivist instruction in that research on learning processes informs on instructional design. What is striking in the Constructivist literature is how different the range of explanations for learning processes can be as a function of the Constructivist position held.

#### **i. Meta-cognitive, cognitive, motivational and affective processes**

Breadth and depth of self-system processes are demonstrated in basic psychological processes identified in cognitive psychology. Meta-cognition refers to the monitoring and controlling of cognition (Zimmerman, Bandura, Martinez-Pons, 1992). This is typically differentiated from regular cognitive processes. Cognitive processes refer to those mental operations required to encode and retrieve information. Wolters (1998) views cognitive processes as goal oriented, strategic, and attentional. Motivational processes refer to the underlying drive or desire towards something. Motivational processes are associated with the directing of effort towards some goal, either intrinsically or extrinsically determined. Affective processes are distinguished from cognitive, meta-cognitive, and motivational processes. Affect has been used to refer to feeling states, moods, and emotional experiences (Newman, 1994).

In contrast to motivational states, affective processes often tend to be more diffuse and sometimes without any specific direction or focus. The diffuseness of certain psychological processes (i.e., feeling, emotion) have made it difficult for cognitive psychology to explain. This is due to the fact that affective processes are largely co-determined processes within the self-system independent of self-consciousness, making these processes difficult for individuals to grasp.

## **ii. Individual Constructivism and volitional processes**

Different views on how to treat intentional and collaborative learning have Views of the self (I) as a substantive category began with the Cartesian theory (Descartes, 1641). While the view was greatly criticized throughout modern philosophy, substantive notions of the self continue to flourish. McCombs & Marzano (1990) view the personal self-structure as the generative structure for self-processes. They state, "To generate the will for self-regulation, students must realize that they are creative agents, responsible for and capable of achieving self-development and self-determination goals, and they must appreciate and understand their capabilities for reaching these goals." This gets at the importance of individual 'self-directedness' quality of learning.

Von Glaserfeld (1995) labels volitional processes as an individual's 'mapping of actions and conceptual operations that had proven viable in the subject's experience. Deci, Ryan, & Koestner's (1999) theory of self-determination is concerned with the degree to which individuals experience their mental processes to be freely chosen rather than being coerced by desired outcomes. They distinguish self-determination from external determination by the extent to which individuals believe they have causal control. At this level, self-determining processes are connected to the concept of "self." Such processes take place at the level of self-consciousness, but there are other processes that cannot be explained within the framework of the "self" concept. This is the case for different levels of processes where self-consciousness does not accompany the processes taking place.

## **iii. Social Constructivism and social processes**

Social processes have also been implicated in the determination of constructivist learning. Much of the work in this area is referred to as social Constructivism, drawing its main theoretical basis from Vygotsky (1987), social activity theorists (Bordieu, 1976; Garrison, 1998; Lave & Wenger, 1991), and pragmatism (Rorty, 1978; Putnam, 1987). Garrison's (1996), approach emphasizes individual's self-realization being derived from actions in the social world. Social processes are largely embedded in a social context characterized by argument, discussion and debate.

Hare (1983) supports the position that individual processes are social in origin and create the various unities of personal identity (sense of personal identity, self-consciousness, agency). The ability to conceive of oneself as a unique singular being is a necessary precondition for the acquisition of a theory of self, experienced as one's sense of identity. Self-consciousness involves both knowing what one is experiencing (consciousness) and that one is experiencing it, which involves the capacity (concept of theoretical self) to be able to make some form of self-reference. Under this view the primary human reality of social processes is taken to be persons in conversation. Hare (1983) states, "The psychological secondary structure is a reflection of the primary structure, the array of persons and their conversation which is the primary reality of the society which brings them into being."

## **VII. Constructivist learning knowledge**

Constructivist learning can also be described in terms of the knowledge structures and capacities attributed to it. Goldstein (1986) refers to knowledge as 'an organized body of knowledge usually of a factual or procedural nature, which, if applied makes adequate job performance possible.'

In this discussion on Constructivist Instruction, knowledge is used to refer to the mental facts, procedures, and strategies individuals rely on when making judgements and carrying out actions. This is to be distinguished from learning processes that refers to how individuals acquire knowledge and skills (Gordan, 1994). This distinction is important for two reasons. First, it maintains the dichotomizing strategy used throughout the paper. Knowledge is an object acquired by subjects through learning processes. Second, distinguishing knowledge from learning processes can allow for advances in understanding. Gordan (1994) states, 'By understanding something about the basic types of knowledge that

experts and novices use in performing tasks, we can enhance the processes involved in front end analysis, instructional system design, and program evaluation.'

Research studying the nature of knowledge and how it is acquired has given rise to various taxonomies being used to provide grounding for instructional program designs (Anderson, 1983; Gagne, 1985; Rasmussen, 1986). The taxonomy employed in this exploratory piece deals with the two types of knowledge traditionally associated with the notions of objectivity and use of subject-object conceptual distinctions. These are scientific knowledge and universal knowledge.

### **i. Universal knowledge**

Rationalist philosophy has provided initial support for viewing human beings as possessing universal knowledge. Spinoza (1677) stated, "Human reason begins in the same reason with its native powers and thus creates its first intellectual tools." Similarly, Piaget's (1954) cognitive development approach posited universal structures of knowledge (e.g. pre logical, concrete, abstract) or general categories that evolved with the biological organism (genetic epistemology).

Discourse on universal knowledge is not limited to individual rational principles but also includes communicative principles which govern all communicative exchange. Habermas' (1989) communicative approach to universal knowledge maintains its individual appeal to rationality while being at the same time deeply related to communicative exchange and has the potential to offer much to educational researchers interested in the theoretical bases of the relation between individual and social learning.

Habermas' Discourse Ethics (1989) seeks to imbed communicative knowledge within a dialectical framework, which acts as the moral determinate. He accomplishes this by treating human consciousness as that which is structured by language exchange within a normative structure of social interactions.

Habermas' modified version of universal morality can be characterized by the following features:

1) Habermas advocates a communicative theory of meaning where validity and truth claims are decided by resolving normative rightness, which can be determined through discursive argumentation.

2) Habermas (1990), summarizes the generalized imperative that corresponds to his theory of argumentative discourse. He states, "All affected can accept the consequences and the side effects its general observance can be anticipated to have for the satisfaction of everyone's interests (and these consequences are preferred to those of known alternatives possibilities for regulation)."

3) The justification of Habermas' universal morality lies in accepting universality as a procedural principal of practical discourse. Habermas' notion of universality ('U') requires that each individual adopts the perspective of all others that are affected by the consequences of argumentative discourse. The types of questions that can be treated in such a manner are those that concern rightness and just regulation of social interactions involving all persons.

For Habermas, moral practices are social matters to be decided by discourse interactions of individually deliberating subjects. Thus, both individual will and community practices are taken into consideration by Habermas' universal theory of argumentative discourse. Habermas supports the causal role of socialization in shaping personal identity as well as the capacity of discourse to represent this.

### **ii. Scientific knowledge**

The assumption at the beginning of this paper attributed to scientific inquiry the notion of objectivity construed as a regulative principle under the Internal Realist stance. Now the question becomes, what is the nature of scientific knowledge within the philosophical framework of Internal Realism? The following answer is provided.

At the level of basic neurophysiological organization there is multiplicity in function. The human brain and its respective components that underlie all cognitive function are not simply limited to specific functions. Edelman (1989) states, "There is no unique structure of combination of groups responsible to a given category or pattern of output. Instead, more than one combination of neuronal groups can yield a particular output, and a given single group can participate in more than one kind of signaling function." Even at the most rudimentary level of the human biological organisms, it is recognized that there is an interactive learning process taking place where some neuronal pathways are stimulated and strengthened with ongoing stimulation, whereas others are not. Dennett (1991) refers to this as the plasticity in nervous systems. This multi-function capacity could be used to help explain intercultural and interpersonal

differences reflected in individuals' learning styles with respect to the various backgrounds from which they evolve.

In addition to multi-functioning capacities, scientific knowledge has been attributed a multi-perspective quality. Science-based knowledge is useful in providing leverage for multiple perspective explanations. Bohr's "complementarity theory" involves particles and waves while Aschby's "Law of Requisite Variety" provide strong support for the complementarity of multiple perspectives (Boyd & Zeman, 1995). The popularity of the Kuhnian notion of "paradigms" in historical scientific inquiry and recent scientific work attest to the recognition of multiple perspectives (Horwich, 1993). Assumptions of complementarity of perspectives pull together evolutionary, genetic, and rational perspectives on universal knowledge. This is an alternative to extreme positions which support either: 1) there being only one accurate description of reality possible (Scientific Realism) or, 2) there being no accurate description of reality possible (Postmodernism). This could prove useful in promoting interdisciplinary approaches to learning with a critical orientation.

Scientific knowledge informs on Constructivist instructional theory in multiple ways. First, knowledge gained from neurological research informs on how the brain structures work, how they develop, and how they can be changed (Edelman, 1992). This contributes by providing information concerning how the mind functions. Edelman (1992) states, "A description of mind cannot proceed liberally—that is, in the absence of a detailed biological description of the brain." It is a limitation that cognitive science has traditionally adopted a functionalist position defining the mind as being made up of mental representations that operate according to a set of definite procedures or computational functions that can be studied independently of underlying structure.

## **VIII. The struggle for a framework to accommodate Constructivist learning processes and knowledge**

In order for a more complete grasp of learning to be achieved, there has to be some way to make intelligible all relevant knowledge structures and mental processes that constitute it. Markus & Wurf, (1987) insist on the need for the integration of the

complex set of intrapersonal (affect, cognition, motivation) and interpersonal (social perceptions, feedback from others) processes.

Efforts to describe learning processes involved in accessing knowledge have resulted in the positing of various descriptions of mental processes and mental models. Johnson-Laird (1983) states, 'Mental models enable individuals to make inferences and predictions, to understand phenomena, to decide what action to take and to control its execution, and above all, to experience events by proxy (p. 397).' Understanding the relationship between knowledge taxonomies and corresponding mental models is a central part of instructional program design and its description. Therefore, the use of information technologies and communication theory in the following discussion addresses both functional and structural aspects.

Insights from neurological research recommend greater attention be paid to human functions that have been difficult to address by concentrating on psychological

processes alone (i.e., affect). Demonstrating the breadth and depth of processes requires a set of knowledge tools to get at those processes that fall beyond methodological approaches employed in cognitive psychology. Damasio (1998) supports there being both a biologically 'core consciousness' that is relatively stable across one's lifetime as well as an 'extended consciousness' with many levels and grades that produce an elaborate sense of self through lifelong individual processes. In this way, what counts as constructivist learning can be seen to extend beyond what individuals are consciously aware.

### **i. Contributions from Cybernetics**

A recent turn in Constructivist instruction to the Cybernetic science offers new insights for instructional designers. Basic Cybernetic systems are organizing systems, operating by feedback mechanisms mediating from system outputs to subsequent system inputs. Bopry (1999) supports that this turn has the potential to provide Constructivist practitioners a 'philosophical mooring within the field itself.' Developments in this field have yielded numerous models of autonomous systems functions used to describe the operation of living and non-living systems (Varela, 1981). Basic autonomous systems can be characterized by four fundamental features: 1) organizational closure, 2) structural determination, 3) structural coupling, 4) proscriptive development.

Organizational closure refers to the organizing of the defining relations of a system necessary for the system to exist. Varela (1981) states "Organizational closure arises through the circular concatenation of processes to constitute an interdependent network." Without organizational closure, autonomous systems could not exist. In the game of chess, were it not that each chess piece had its respective operations on the chessboard, chess could not exist. Structural determination refers to the internal dynamics of autonomous systems responsible for structural change. Autonomous systems are limited by the interactions that its structure makes possible. Humans do not have the necessary wing structure to fly as do birds. However, human structural determination does allow for walking. Structural coupling refers to the interactions that autonomous systems have with the environment. Bopry (1999) states, "When a unity is in continuous interaction with the environment, so there is a mutual triggering of structural change over time that is stable in nature, the unity and the environment are said to be structurally coupled." Maturana & Varela (1987) support that structural coupling represents the basis for higher order cognitive development. Proscriptive development describes how it is that nature constrains living organisms during the process of evolutionary change. Varela (1991) states, "In a proscriptive context natural selection can be said to operate, but in a modified sense: selection discards what is not compatible with survival and reproduction."

Proscriptive functions are not limited to explanations of biological evolution. Bopry (1999) connects proscriptive development with culture and language use. Bunge's (1977) emergent level cybernetic theory and Boyd's (1993) cybersystemic theory provide explanations for multiple levels of emergent processes that include neurophysiological, autobiographical, and psycho-social processes.

Damasio's (1998) linking of conscious processes to neural architecture supports a general anatomy of consciousness.

Cybernetic's attention to the role of structure and organization in structural change runs concurrent with the underlying assumptions of this paper pertaining to subject-object conceptual distinctions. The subject-object conceptual distinction reappropriated as a Cybernetic structural-organizational conceptual distinction is supported by views of the commensurability of universal and scientific knowledge.

From an evolutionary perspective, a universal drive for self-preservation is recognized that binds individuals together in communicative collectives (Gould, 1986; Dawkins, 1973). Evolutionary theory supports the universal human drive to create (propagate) one's self (Darwin, 1871), one's genes (Dawkins, 1976), or one's mental representations or 'memes' (Blackmore, 1999). Cybernetics and evolution theory provide support for viewing human beings as possessing universal knowledge tools (Blackmore, 1999; Boyd & Zeman, 1993).

To take this one step further, Boyd (1993) supports the aesthetic critique as a universal knowledge tool. Advancements in aesthetic education have their biological origins in early attractiveness/repulsiveness experiences with the world. This basic level of biologically evolved perceptual engagement forms the basis of what later may develop into personalized and socialized preferences. Gabora (1997) supports that, in line with evolutionary theory, mental representations (or memes) evolve through adaptive exploration and transmission of information by way of variation and selection. This can be employed to explain the evolution of culture and creativity. Boyd & Zeman's (1993) notion of "generative concepts" is treated as a set of actively developing tools that function on a meta-level as principles for conceptual organization.

Cybernetics has the potential to make two important contributions to Constructivist Instructional theory. First, it gets at a depth of Constructivist learning that has been neglected in contemporary instructional design theory. This can be used to provide a basis for inquiry into a greater range of learning processes than has been considered in instructional theory. Second, there is also an important recognition of the genetic epistemological structures that have a causal role within the complex set of learning processes that instructional designers are interested in. The potential for the inclusion of science is quite attractive for instructional theories like Constructivist that do not provide obvious "self-correcting" mechanisms for interventions designed.

## **ii. Recursive communication**

Krippendorff (1994) advances a recursive theory of communication based on assumptions of the self-referential quality of human communication. This approach to human communication focuses on the process of communicating as well as what is communicated. It puts forth the following propositions:

- 1) Human communication theory must also be about itself.
- 2) Everything said is communicated to someone understanding it as such.
- 3) Human communication constitutes itself in the recursive unfolding of communication constructions, held by participants (including of each other), into intertwining practices that these participants can recognize and explain in terms of being in communication.

This approach to human communication contains two defining features that are crucial to Constructivist Instructional design. First, it acknowledges self-referential quality of experience. Asserting that communication theory is about itself is to recognize that individuals experiences (even acts of theorizing about communication) are not products of the outside world but rather, are constructed from within the realm of one's own experiences. Krippendorff (1995) states, 'Whatever gives rise to the awareness of something being said and communicated, the causes of one's experiences, must be located within one's horizon of understanding.' As such, individuals are responsible for constructing their own communication and the communication of others

Second, it recognizes the recursiveness of human experience. Individuals monitor their communications, transforming the consequences of actions into information that revises knowledge used to direct future actions. It maintains the necessary positioning of oneself within communications which includes other human beings and to attempt to understand others perspectives.

Together, Cybernetics and Recursive Communication Theory represent innovative approaches for the linking of Constructivist learning processes and knowledge under a complementary dualistic framework. Instead of conflating object-subject distinctions, this view suggests that it is possible to make

connections between complementary knowledge/structures and processes/functions that advance understanding. To illustrate:

Table 2: A complementary framework for Constructivist learning processes and knowledge  
Constructivist Learning Processes

Constructivist Learning	Processes -Knowledge	Constructivist Learning Knowledge
Individual Constructivism	Cybernetics	Scientific Knowledge
Social Constructivism	Recursive Communication	Universal Communicative Knowledge

The Communicative Constructivist Perspective (CCP) presented next takes the resolution of the Paradox of Constructivist instruction to be its primary focus. It does so largely by drawing together the theoretical strands discussed thus far.

### IX. Communicative Constructivist Perspective (CCP): A multi-level, multi-perspective account

CCP is proposed to describe the breadth and depth of Constructivist learning experienced by individuals living within a community of learners. The first fundamental criterion concerns the importance of viewing meaning construction from multiple perspectives (aspects) and sharing these perspectives in such a way as to shape individual and collaborative learning. This gets at the need for both individual expression and collaborative communication where individual expressions occur and develop within individuals' sharing of subjective experiences.

In practical terms, students' learning experiences do not take place in isolation. Learning involves all individuals who partake in the ongoing communication and decision making together. This minimally includes, learners, parents, teachers, and administration coming together to express views in ongoing discussions.

The second fundamental criterion of CCP concerns employing definition of Constructivism that is broad enough to capture the multiplicity of knowledge structures (Boyd & Zeman, 1993; Cobb & Yackel, 1996; Edelman, 1989; Hare, 1983) at the various levels of meaning production (biological, psychological, social) that influence learning experiences. CCP addresses structural knowledge and self-systems processes that have been identified both outside and within Constructivist, Situated-Cognition, and Self-regulated learning literatures (Cobb, 1994; Yang, 1993; Zimmerman, Bandura, & Martinez-Pons, 1992). In practical terms, learning is assumed to be multi-perspectual and therefore, requires flexible multi-level knowledge to be accommodated within higher-order learning activities in order to explain its complex nature within a community of learners. This is essential in interdisciplinary programs of educational instruction where students are exposed to a diverse range of educational content.

When designing education, it is important to recognize that what constitutes individual learners extends beyond psycho-social processes and our sense of self. In order to develop individual and collaborative learning, efforts should be directed at both the learner and the learning environment. For this reason, educational design requires theoretically grounded proscriptive and prescriptive necessary conditions. Utilizing a CCP for the purpose of educational design could result in adopting the following orientation:

Table 3: Key Postulates of the CCP Perspective

CCP Postulates	Description
Critical Orientation.	Not all subjectively constructed meaning will be equally accurate and it is an asset to be able to critically evaluate learning constructions.
Process and Identity Orientation.	Because this real world is subjectively experienced by each individual within a social realm, there is a dual need to develop one's own learning processes and personal/social identity.
Multiple-Perspectives	Many viewpoints or perspectives contribute to a more complete understanding which more closely approaches the truth.



Communicative Orientations	Constructivist learning often involves students, parents, teachers, and all other stakeholders.
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This draws together much of the Constructivist learning mentioned already in an effort to apply it to individually meaningful collaborative learning process. Some of postulates (i.e., authentic and collaborative learning, decision making, communication skills development, etc.).

The CCP general orientation outlined could contribute to education applied to the design of interventions in order to modify the structuring and content of instruction in an effort to raise individuals' awareness of humans complex organisms amongst other complex organisms interconnected at various levels within the learning environment.

## **X. Educational and scientific contribution**

Overall the notion of objectivity assumed to be a regulative principle was supported by efforts throughout the paper to demonstrate the complementarity of Constructivist Instruction informed by science and communicative theory.

First, it could offer a causal account of learning. Causal explanations are well suited for explaining general measures of student functioning such as attitude and achievement (Zimmerman, 1986). There are very few causal explanations to be found in Constructivist or self-regulated learning literatures (McCombs & McCombs, 1990). Causal accounts have an explanatory value that could provide a great contribution to the Constructivist literature if fully developed.

Second, it could act as a multi-level explanation, addressing learning at multiple levels where it occurs (physiological, psychological, social). This is an emergent-level perspective in that there are simultaneous levels of learning emerging at the same time with their own respective properties (Bunge, 1979). However, it is also a causal explanation, maintaining the subject-object separation that other accounts (i.e., symbolic interactionism) do not uphold.

Third, CCP could be used as a multi-function explanation, concerned with the necessary flexibility of learning (i.e., learner style, self-efficacy, intention, etc.). It could also include consideration of contextual functioning (i.e., meta-cognitive and cognitive strategic planning, goal-orientation, learner control, etc.).

Fourth, it could be used to uphold the distinction between knowledge structures and processes that underlie individuals' psychological processes and abilities to be self-determined learners within a community of learners. Being able to attend to both knowledge and processes is considered essential to achieving a more complete grasp of Constructivist learning. The strategic integration of these elements offers a philosophical 'mooring' for Constructivist Instructional Theory and Practice.

An objective communicative set of procedures can also address standards of evaluation required for effective instruction. The contribution to be made lies in how it is that standardized evaluative measures essential to instruction are treated. Under this view, problems of evaluation are resolved by Constructivist instructions' prescriptive function. First, evaluations would not simply be administered but would be integrated as part of the learning process. This can be accomplished by making clear who is responsible for creating the evaluative standards and when. This way students can feel they are not merely subjected to some imposed standard, but rather are participating in the standard evaluation. This is done so that students can learn to understand the standard as a first step in being able to participate in the evaluation and selection of future standards. This can be taken to be a type of cognitive apprenticeship (Clancy, 1992; Cobb, 1996; Collins, 1991).

Second, learners are participating in standard evaluations administered not with the understanding that the standard is true but rather, is a logical possibility, objectively true for all learning participants and to be worked towards in a cooperative manner (Habermas, 1995; Kagan, 1990). This captures the essence of what Constructivism should encourage when attempting to provide instruction in an educational setting.

## **Conclusion**

The multi-level CCP offered an alternative to the paradox of Constructivist instruction by focusing on recent developments in Cybernetics and communicative theory to get at a depth of

Constructivist learning neglected in contemporary instructional design theory. Support was given to demonstrate that what affects each of us as learners extends beyond our psycho-social processes. The present discussion focused on these underlying elements of learning in demonstrating their potential implications for the development of learning interventions.

Future work will be directed at developing educational interventions that raise the general awareness of the complex set of learning processes and knowledge that arise from individual and collaborate Constructivist instruction. This could be beneficial in promoting self aware and socially responsible learning.

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# USING SMIL TO CREATE A WEB-BASED MULTIMEDIA VIRTUAL LIBRARY TOUR

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## *Abstract:*

This article shows how to use SMIL to create an Online Multimedia Virtual Library Tour. The presentation is composed of a slide show of text and still images, which introduces the library. It is accompanied by background audio and a caption. In this presentation there are hyper-links to related library web sites.

URL: <http://www.asu.edu/lib/webcom/yuwu/VisualTour/visualtour.smil>

To view this file, you need a RealPlayer plug-in which can be downloaded free from: <http://www.real.com>.

The Virtual Library Tour presentation is created by using Synchronized Multimedia Integration Language (SMIL). SMIL as a new web format allows us to put text, still photos, audio, video, and animation into interactive presentations. The World Wide Web Consortium on June 15, 1998 ([www.w3.org/tr/rec-smil](http://www.w3.org/tr/rec-smil)) published the specification which defines SMIL as an application of XML. The specification depicts the design layout and temporal behavior of multimedia presentations.

With SMIL, you can produce interactive multimedia presentations of broadcast quality. You can provide links within a presentation that access other presentations, other media files, or web sites. Before the streaming technology came into being, multimedia files such as MPEG video or AIFF audio had to be downloaded completely before we could see them play. Streaming technology allows multimedia servers send a file in a continuous stream that can be played back shortly after the local machine get parts of the files. It would take a few minutes for a traditional video file to be downloaded while for a streaming video, it only takes a few seconds before you can view it.

To create, publish, and broadcast SMIL presentations, all you need is a PC and access to a compatible server. To see SMIL in action, you need a compatible player such as RealPlayer G2 (free, downloadable from <http://www.real.com>.) Once you download and install the player, you can view SMIL presentations. You can also access SMIL presentations from the Web. When you do this, your browser launches the SMIL player, which in turn displays the presentation.

Like HTML, SMIL is a subset of XML, and because XML is defined using text markup tags, you could make the layout and design of SMIL presentations using a regular text editor such as NotePad.

SMIL's media object tags allow you to put various media types in your presentations, and they are self-explanatory. The <audio> tag supports audio files such as AIFF. The <video> tag supports video formats such as RM files. The <img> tag is for still images such as JPEG files or RealPix. The <text> tag is for static text files; the <text src> or <textstream> tag is for streaming text files such as RealText. You can mix any of the available media types in your presentations.

The presentation layout determines how you set up your screen. SMIL players have a window. When you want to play multiple media types simultaneously, you need to create regions or mini-windows within the main window.

Regions are like cells within a HTML table. You can decide the size and position of the window as well as the size and position of the mini-windows within it. The root-layout sets the height and width of the entire presentation in pixels. This is the whole player area, which will be divided into regions. Each region sets specific areas in the presentation that media will play in.

<layout>

<root-layout height="405" width="770" background-color="black"/>

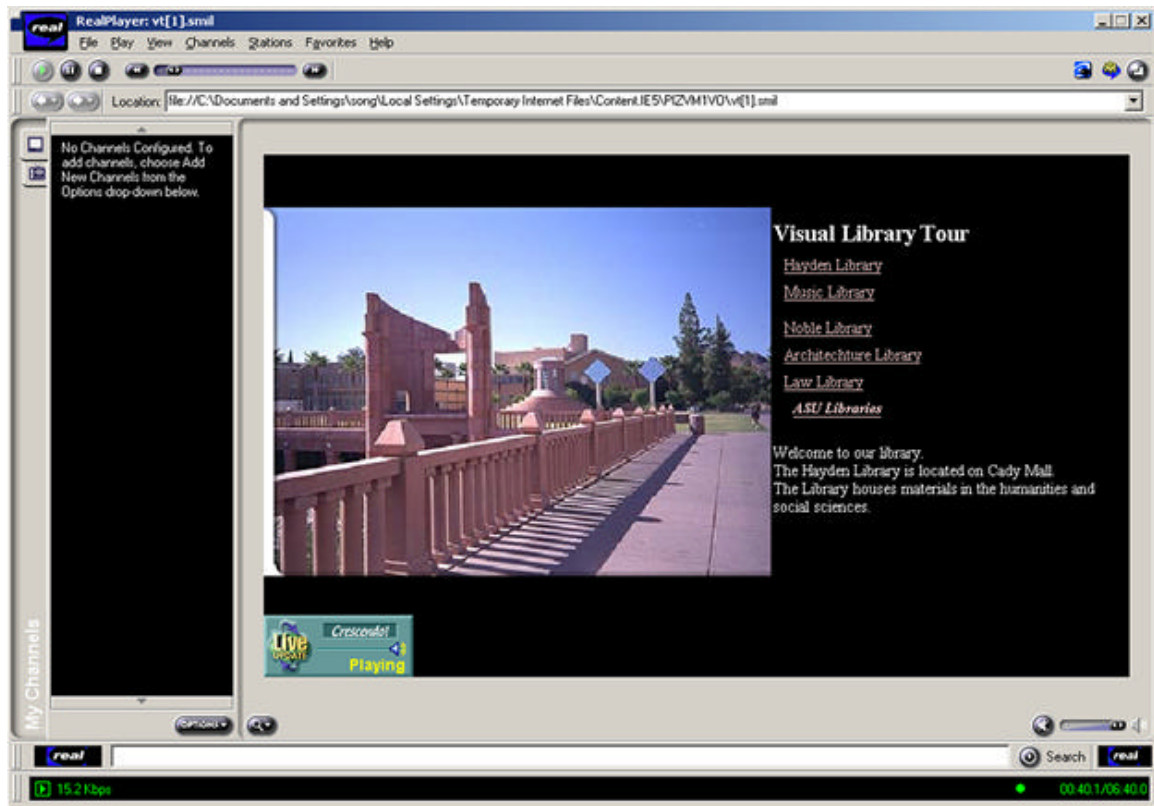
<region id="title" left="5" top="120" width="400" height="200" z index="1"/>

```

<region id="full" left="0" top="0" height="425" width="450"
background-color="#602030"/>
<region id="video" left="450" top="240" height="120" width="315" z-index="1"/>
<region id="toc" left="450" top="0" height="405" width="255"/>
</layout>

```

First we size the main window (identified with the <root-layout>tag) to 405 by 770 pixels and then create 4 mini-windows within the main window: title, full, video, and toc. The title region is positioned 5 pixels to the right of the main viewing area's left edge and 120 pixels down from the top of the main viewing area. The other regions are placed according to their respective pixels. By defining layout regions, you can combine multiple forms of media and display them simultaneously. The following picture will show you how the interface looks like.



Let's take a look at how SMIL combine media files and make them play. The following code shows an example of event timing:

```

<par>
  <audio src="http://www.asu.edu/lib/webcom/yuwu/VisualTour/smone2.rmi"
dur="400s"/>
  <text src="http://www.asu.edu/lib/webcom/yuwu/VisualTour/toc.rt" region="toc"/>
  <text src="http://www.asu.edu/lib/webcom/yuwu/VisualTour/song.rt" region="video"/>
</seq>

```

<!-- This part displays the title screen and the caption with an audio soundtrack-->

```

<text src="http://www.asu.edu/lib/webcom/yuwu/VisualTour/title.rt"
type="text/html" region="title" dur="35s"/>

```

<!-- This section displays a slide show -->

<par>

```

```

</par>

<!-- This section contains the annotated slideshow -->

<par>

```
<switch>

</switch>
```

</par>

</seq>

</par>

SMIL offers two ways to play media elements: sequentially (one file right after another in a single region), where a few files: text, audio, or video files can play at the same time. Each line between the <par></par> tags is a media file which will play to a specified region. The <par> tags mean that media files will play simultaneously (in parallel). The <seq> </seq> tags mean that they will play sequentially. Fill="freeze" means that the final frame will stay visible when that media file is done.

When the presentation starts, the text file toc.rt displays. The audio clip smone2.rmi also begins. Then the text file title.rt clip specified in the next line starts at 35' into the presentation. Then the slide show begins. While the audio clip is playing, the text and slide show are displayed. By adding a time line to a presentation, you can control when content is displayed and how transitions between various content types are handled. SMIL provides sophisticated control the protocol offers.

One feature of SMIL is that by setting choices, you can even serve up different versions of the production based on the available bandwidth. In other words, you can use the <switch> tag to get the player to use media files appropriate to the bandwidth.

<switch>

```

```

</switch>

The presentation's bandwidth needs are optimized based on the speed of your computer's connection to Internet. The media files used in the presentation will depend on whether you have a 28.8 modem or a high-speed connection such as a T1 line. This feature makes it possible that users enjoy the presentation regardless of their connection speed. You can include low- and high-bandwidth choices. The <switch> tag tells the player it should make a choice. The bandwidth choices are made in the order listed, the highest-bandwidth choice should come first.

One of the greatest advantages of SMIL is synchronization. SMIL offers quite a few features for handling the timing of media playback. One can set specifically a duration for a media clip. For example, you can assume that the file will play for 3 minutes. You can time events according to the time line for the entire presentation. You can let a media file begin 10 seconds into the presentation and end 15 seconds into



the presentation. You can decide what should take place at the end of the presentation. For instance, you can remove all graphics or video clips from the display or you can freeze still images on the last frame.

You can use special effects like fadein, crossfade, viewchange, and wipe target in your slideshow presentation. For each special effect, attributes such as start specify the time to begin, duration how long the picture lasts, and target the source of the picture. For example: <crossfade start="00:45" duration="00:08" target="5"/>.

You'll likely be using a lot of file formats when you create your multimedia production. Keep in mind, you should transfer all standard animation, video, and audio file formats to streaming formats, such as RealFlash, RealVideo, and RealAudio.

When you complete presentation, you should move the multimedia files and the SMIL file to the web server. The server should be configured to handle multiple forms of media including text, audio, video, and animation, and they should understand hypertext links. If the server supports all the media formats such as ra, rt, rm, rp, smil, etc., you can view the presentation in your SMIL player such as RealPlayer G2, GRiNS (GRaphical iNterface to SMIL), or HPAS (Hypermedia Presentation and Authoring System).

#### *Appendix: Source Codes for the Virtual Library Tour:*

***You can create your own presentation by customizing the following codes, that is, changing the variables and replacing text, audio, graphic files with your own.***

##### *1. vt.smil code:*

```
<smil>
  <head>
    <layout>
      <root-layout height="405" width="770" background-color="black"/>
      <region id="title" left="5" top="120" width="400" height="200" z-index="1"/>
      <region id="full" left="0" top="0" height="425" width="450" background color="#602030"/>
      <region id="video" left="450" top="240" height="120" width="315" z-index="1"/>
      <region id="toc" left="450" top="0" height="405" width="255"/>
    </layout>
  </head>
  <body>
    <par>
      <audio src=http://www.asu.edu/lib/webcom/yuwu/VisualTour/smone2.rmi
        dur="400s"/>
      <text src="http://www.asu.edu/lib/webcom/yuwu/VisualTour/toc.rt" region=toc"/>
      <text src="http://www.asu.edu/lib/webcom/yuwu/VisualTour/song.rt" region="video"/>
    <seq>

<!-- This part displays the title screen and the caption with an audio soundtrack-->

      <text src="http://www.asu.edu/lib/webcom/yuwu/VisualTour/title.rt"
        type="text/html" region="title" dur="35s"/>

<!-- This section displays a slide show -->

    <par>

      <img src=http://www.asu.edu/lib/webcom/yuwu/VisualTour/map.rp
        region="full" fill="freeze"/>
```

</par>

<!-- This section contains the annotated slideshow -->

<par>

<switch>



</switch>

</par>

</seq>

</par>

</body>

</smil>

## 2. toc.rt code (for the table of content):

<window type=generic duration="6:30.0" scrollrate=0 height=250 width=375 bgcolor="#000000"  
link="#DDBBBB" loop=true>

<time begin="00:02"/><font size="5" color="white" face="times"><pos y="10"/>

<br>

<br>

<br>

<b>Visual Library Tour</b>

<br>

<time begin="00:05"/>

<font size="3" color="white" face="times">

<a href="http://www.asu.edu/lib/hayden/">Hayden Library</a></font>

<br>

<time begin="00:07"/>

<font size="3" color="white" face="times">

<a href="http://www.asu.edu/lib/music">Music Library</a></font>

<br>

<time begin="00:9"/>

<font size="3" color="white" face="times">

<a href="http://www.asu.edu/lib/noble/">Noble Library</a></font>

<br>

<time begin="00:11"/>

<font size="3" color="white" face="times">

<a href="http://www.asu.edu/caed/AEDlibrary/">Architechure Library</a></font>

<br>

<time begin="00:13"/>

<font size="3" color="white" face="times">

<a href="http://www.lawlib.asu.edu/">Law Library</a></font>

<br>

```

<time begin="00:15"/>
<font size="3" color="white" face="times">
<a href="http://www.asu.edu/lib/"><i><b>ASU Libraries</b></i></a> </font>

</window>

```

### 3. title.rt code (for the title):

```

<window type="generic" bgcolor="#602030" WIDTH="400" HEIGHT="200">
<center><font size="6" color="white">
<time begin="00:20"><center><i><b>The Arizona State University University Libraries</b></i></font>
<font size="4" color="white">
<br/>
<br/>

<time begin="00:22">A Visual Library Tour

<time begin="00:26"><clear/>

<time begin="00:28"><pos y="50">Welcome and enjoy a visual experience!</center></font>

<time begin="00:30"><font size="3" color="white"><i><b><p>-- LIST, ASU</b></i></font></center>

</window>

```

### 4. map.rp code (for the slideshow):

```

<imfl>
  <head duration="01:05"
    width="450"
    height="425"
    bitrate="13500"
    preroll="00:20"
    aspect="true"
    timeformat="dd:hh:mm:ss.xyz"/>

  <image handle="1" name="hayden1.jpg"/>
  <image handle="2" name="hayden4.jpg"/>
  <image handle="3" name="noble-r.gif"/>
  <image handle="4" name="musicentrance.jpg"/>
  <image handle="5" name="architecture.jpg"/>
  <image handle="6" name="law.jpg"/>

  <fadein start="00:01" duration="00:02" target="1"/>
  <crossfade start="00:06" duration="00:15" target="2"/>
  <viewchange target="2" start="00:25" duration="00:05" srcx="290" srcy="139" srcw="118"
    srch="115"/>
  <crossfade start="00:30" duration="00:02" target="3"/>
  <wipe target="4" start="00:35" duration="00:08" type="normal" direction="down"/>
  <crossfade start="00:45" duration="00:08" target="5"/>
  <crossfade start="00:55" duration="00:10" target="6"/>
</imfl>
</window>

```

## 5. slideshow.rp code (codes for the slideshow):

```
<imfl>
  <head
    duration="04:15"
    bitrate="20000"
    width="450"
    height="425"
    aspect="true"
    timeformat="dd:hh:mm:ss.xyz"
    preroll="80" />

    <image handle="1" name="hayden.jpg"/>
    <image handle="2" name="hayden2.jpg"/>
    <image handle="3" name="hayden3.jpg"/>
    <image handle="4" name="hayden4.jpg"/>
    <image handle="5" name="hayden5help.jpg"/>
    <image handle="6" name="hayden6circ.jpg"/>
    <image handle="7" name="hayden7ada.jpg"/>
    <image handle="8" name="hayden8study.jpg"/>
    <image handle="9" name="hayden9ill.jpg"/>
    <image handle="10" name="hayden10workstation.jpg"/>
    <image handle="11" name="hayden11ref.jpg"/>
    <image handle="12" name="hayden12mars.jpg"/>
    <image handle="13" name="hayden13level1.jpg"/>
    <image handle="14" name="hayden14curr.jpg"/>
    <image handle="15" name="hayden15spcoll.jpg"/>
    <image handle="16" name="hayden16asia.jpg"/>
    <image handle="17" name="hayden17lab1.jpg"/>
    <image handle="18" name="hayden18gov.jpg"/>
    <image handle="19" name="hayden19azm.jpg"/>
    <image handle="20" name="hayden20ahf.jpg"/>
    <image handle="21" name="hayden21period.jpg"/>
    <image handle="22" name="hayden22currperiod.jpg"/>
    <image handle="23" name="hayden23micro.jpg"/>
    <image handle="1" name="hayden.jpg"/>

    <fill start="0" duration="00:01" color="#602030"/>
    <fadein start="00:02" duration="0:03" target="1"/>
    <crossfade start="00:10" duration="00:03" target="2"/>
    <crossfade start="00:20" duration="00:03" target="3"/>
    <crossfade start="00:30" duration="00:03" target="4"/>
    <crossfade start="00:40" duration="00:05" target="5"/>
    <crossfade start="00:50" duration="00:05" target="6"/>
    <crossfade start="01:00" duration="00:05" target="7"/>
    <crossfade start="01:10" duration="00:05" target="8"/>
    <crossfade start="01:20" duration="00:05" target="9"/>
    <crossfade start="01:30" duration="00:05" target="10"/>
    <crossfade start="01:40" duration="00:05" target="11"/>
    <crossfade start="01:50" duration="00:05" target="12"/>
    <crossfade start="02:10" duration="00:05" target="13"/>
    <crossfade start="02:20" duration="00:05" target="14"/>
    <crossfade start="02:30" duration="00:05" target="15"/>
    <crossfade start="02:40" duration="00:05" target="16"/>
```

```

<crossfade start="02:50" duration="00:05" target="17"/>
<crossfade start="03:00" duration="00:05" target="18"/>
<crossfade start="03:10" duration="00:05" target="19"/>
<crossfade start="03:20" duration="00:05" target="20"/>
<crossfade start="03:30" duration="00:05" target="21"/>
<crossfade start="03:40" duration="00:05" target="22"/>
<crossfade start="03:50" duration="00:05" target="23"/>
<crossfade start="04:00" duration="00:05" target="1"/>

<fadeout start="04:10" duration="00:5" target="1"/>

</imfl>

```

#### 6. song.rt code (codes for the caption):

```

<window type="teleprompter" bgcolor="black" duration="266"><font color="white">
<br/><time begin="36"/>Welcome to our library.
<br/><time begin="37"/>The Hayden Library is located on Cady Mall.
<br/><time begin="40"/>The Library houses materials in the humanities and social sciences.
<br/><time begin="43"/>They include business and education.
<br/><time begin="46"/>It has a number of specialized collections including Government Documents.
<br/><time begin="49"/>1. *****
<br/><time begin="52"/>2. *****
<br/><time begin="263"/>*****.
<br/><time begin="264"/>Welcome to our library.
</font>
</window>

```

# INTERMATH<sup>14</sup>--PROFESSIONAL AND COGNITIVE DEVELOPMENT THROUGH PROBLEM SOLVING WITH TECHNOLOGY

Evan Glazer  
University of Georgia

InterMath project group  
<http://www.intermath-uga.gatech.edu/>

How can teachers teach a mathematics that they never have learned,  
in ways that they never experienced?

Cohen and Ball, 1990

## Abstract

*InterMath is a statewide Internet-based (<http://www.intermath-uga.gatech.edu/>) project with the goal of designing and implementing a series of workshops and ongoing support programs that feature contemporary applications of **technology** and **mathematics pedagogy** in the **middle-grades**. Technology is used to deliver the curriculum through web-based materials and to explore the mathematics using cognitive tools such as dynamic geometry software, spreadsheets, and graphing calculators. Objectives of InterMath include*

- *strengthening the middle school teacher's knowledge and understanding of mathematics,*
- *providing a support structure (on-line & in-school) to aid teachers in implementing and integrating technology tools for doing mathematics, and*
- *providing a structured inservice curriculum that follows Georgia's Quality Core Curriculum objectives as well as reform efforts expressed in publications by the National Council of Teachers of Mathematics.*

*InterMath is a collaborative effort among the University of Georgia,, Georgia Institute of Technology, and nine regional technology centers in the state of Georgia. InterMath, a five-year effort to design and implement a series of field-based workshops and ongoing support programs to assist both teachers and administrators in effecting mathematics reform, is funded through the National Science Foundation.*

## Rationale

### A Vision for School Mathematics

The pedagogical shifts embodied in a series of documents published by the National Council of Teachers of Mathematics (NCTM) emphasize vastly different approaches to mathematics teaching and learning than are typical in today's classrooms (NCTM, 1989, 1991, 1995, 2000). Rather than static knowledge and skills detached from both other domains and everyday events, mathematics is viewed as problem solving, reasoning, and communicating so that students are empowered to confidently "explore, conjecture, and reason logically [about the world around them]" (NCTM, 1989, p.5). This change in learning philosophy reflects a need for mathematics that is based in an information-rich and technology-based society. Learning goals should incorporate values that reflect mathematics for life, mathematics as a part of cultural heritage, mathematics for the workplace, and mathematics for the scientific and technical community (NCTM, 2000).

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<sup>14</sup> The InterMath project has been funded by the National Science Foundation [Grant #9876611]. The views and opinions of the authors do not necessarily represent those of the National Science Foundation.

NCTM (2000) suggests that the direction of mathematics education should involve six core principles: equity, curriculum, teaching, learning, assessment, and technology. The equity principle stresses the need for reasonable expectations, opportunities, resources, and support for all students in learning mathematics. Students should have access to different forms of technology that will help them generate ideas and support their thinking. The curriculum principle focuses on the need to develop a clear, coherent plan to promote important mathematics. Concepts in the curriculum should relate to other mathematical ideas and be used to promote mathematical thinking and reasoning. The use of technology encourages these mathematical connections by allowing students to understand, visualize, and conjecture about new or unfamiliar concepts.

In reform-based mathematics classrooms, teachers are not merely keepers and transmitters of mathematical knowledge; they facilitate student engagement by posing relevant problems that encourage deep mathematical thinking involving analysis, problem finding and problem solving, that result in a rich conceptual understanding. Thus, the teaching principle emphasizes that teachers need to be well-versed in mathematics and pedagogy, including how students learn mathematics and the most effective learning environments, in order to fulfill this role. Similarly, the learning principle emphasizes the need for understanding mathematical concepts. According to the Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989), conceptual understanding "enables children to acquire clear and stable concepts by constructing meanings in the context of physical situations and allows mathematical abstractions to emerge from empirical experience" (p. 17).

The assessment principle identifies assessment as a tool for enhancing learning and informing instructional decisions. Assessment should support continual and reflective learning based on values, multiple sources of information, and feedback, so that learners take responsibility for their ideas. Technology use not only influences how and what mathematics is taught, but it also gives students an opportunity to construct and express their mathematical ideas through their own creations and interpretations. However by itself, "technology is not a panacea" because any teaching tool can be used poorly (NCTM, 2000, p. 25).

Teachers should be provided extended opportunities to experience and do mathematics in an environment supported by diverse technologies (Dreyfus & Eisenberg, 1996). The development of mathematical understanding occurs when technology is used as a cognitive tool that supports thinking, reasoning, and problem solving (Jonassen and Reeves, 1996). The use of cognitive tools such as dynamic geometry, graphing calculators, spreadsheets, and symbolic processors, can provide opportunities and experiences for exploration, developing understanding, interpreting and communicating about mathematics (see Bransford, et al, 1996; Schoenfeld, 1982, 1989, 1992; Silver, 1987). Our approach in the InterMath project focuses on developing mathematical power--understanding, using, and appreciating mathematics.

### **Barriers to and Proponents of Reform**

Reform, however, does not occur simply because new standards or approaches emerge. Several barriers have hampered reform efforts. One barrier appears to be linked to resilient and pervasive beliefs among preservice and inservice teachers as to what constitutes mathematics (Ball, 1988; Dossey, 1992; Thompson, 1984; 1992). Even and Lappan (1994) identified several widely held teacher beliefs: (1) computational proficiency is the major mathematics curriculum goal; (2) mathematical knowledge is rule bound and unconnected; (3) teaching is telling and learning is memorizing (p. 129). Howson, Keitel, and Kilpatrick (1981) noted that many curriculum projects fail because teachers tend to proceduralize methods in ways that are often inconsistent with the curriculum's underlying epistemological and pedagogical assumptions. This has been particularly evident in the use of widely available drill-and-practice programs that could be used to support emerging pedagogies, but rarely are. Cohen (1990), for example, documents the activities of a well-intentioned teacher who, based on lectures about reform mathematics, believed her methods were consistent with the current reform movement. However, she never actually experienced "doing mathematics" or learning mathematics in these new ways herself. While her intent and motives were admirable, the lack of experience in participating as a learner inherently limited her understanding and insight in implementing the approaches. In order to promote conceptual change, teachers must themselves experience mathematics as we want our students to: as conjecturing, reasoning, communicating, and

problem solving. Such experiences should prompt teachers to examine their fundamental beliefs about such questions as, "What is mathematics?," "What does it mean to know mathematics?," "How do students learn mathematics?," and "What is the role of the teacher in the mathematics classroom?"

Research in mathematics education suggests that a teacher's conception of mathematics has a strong impact on how mathematics is approached in the classroom (Cooney, 1985; Thompson, 1984; 1992). Furthermore, the nature of the classroom environment in which mathematics is done strongly affects how students view the subject and how it should be taught and learned. A common theme found throughout the reform documents is "What students learn is fundamentally tied to how they learn it" (NCTM, 1989, p. 5; NCTM, 1991, p. 21). Thus, if we want our students to view mathematics not as a static body of rules and procedures, but as a meaningful and dynamic, yet connected body of knowledge, we must make an impact on their teachers' views of mathematics.

In short, if we want our teachers to meaningfully teach mathematics, they must experience meaningful mathematics. In the words of Cohen and Ball (1990), "How can teachers teach a mathematics that they never have learned, in ways that they never experienced?" We cannot expect teachers to teach in a manner consistent with reform advocates simply because they have been told what to do or how to do it. To help our teachers meaningfully teach and model mathematical thinking, they must experience relevant mathematics as learners, benefiting from both the discovery processes as well as guidance from and modeling of capable peers. To break the cycle of stagnant curriculum and pedagogy, better teacher models are needed at all levels, K-12 through university.

## **Project Overview**

### **Description and Goals**

InterMath (<http://www.intermath-uga.gatech.edu/>) is a statewide Internet-based project with the goal of designing and implementing a series of workshops and ongoing support programs that feature contemporary applications of technology and mathematics pedagogy in the middle-grades.

InterMath has two primary teacher components:

- workshops comprised of in-class portions and a "follow-along" component in which participants create curriculum for use in their own classrooms.
- an ongoing system to support teachers beyond the initial laboratory/workshop.

Intensive support will be provided throughout the workshops under the close tutelage of InterMath facilitators distributed throughout the state. The site-based component will focus heavily on scaffolding in-school reform efforts. As participants near completion of the laboratory portion, they will transition to the ongoing support system--a peer community to ensure continuity beyond the laboratory.

The ongoing support system is supported by the [Learning and Performance Support Laboratory](#) (University of Georgia) and the [Center for Education Integrating Science, Mathematics, and Computing](#) (Georgia Institute of Technology) where shared resources and communication tools are provided; customization of support will be ensured through distributed implementation sites. Three [INTECH](#) (INtegrating TECHnology in the student-centered classroom) centers at the University of Georgia, Valdosta State University, and Kennesaw State University will be initially certified as InterMath sites. They will then mentor both subsequent InterMath INTECH centers as well as serve as regional support base for participants. During the project, we will establish a geographically distributed community of educators, K-12 through universities, who are committed to sustaining technology-enhanced middle-grades mathematics teaching and learning reforms. This community will be connected and supported through shared web-based resources, e-mail, and listservs.

Project goals and objectives reflect multiple targets aimed at involving teachers and administrators in technology-enhanced mathematics reform. They link the epistemological, pedagogical, and logistical activities designed to support [QCC](#) and [NCTM standards](#).



Goal 1: Promote innovative practices in the tool uses of technology in middle-grades mathematics teaching and learning.

- To use technology tools to model and demonstrate standards-referenced mathematics content and pedagogy for the middle school.
- To enable teachers to experience mathematics using various technologies so that they can explore real world applications, engage in problem solving, and communicate about their investigations.
- To use technology to understand the distinction between demonstration and proof in mathematics and to emphasize the value of each in the understanding of mathematics.
- To use technology to engage in mathematics explorations, to form mathematics ideas, and to solve mathematics problems.
- To use technology tools to construct new and personally meaningful ideas of mathematics.
- To use general tools such as word processing, paint programs, spreadsheets to facilitate mathematics investigations and communication.

Goal 2: Revitalize middle-grades mathematics teaching and learning by modeling, then applying, innovative technology-enhanced approaches.

- To develop effective mathematics demonstrations using appropriate technology tools.
- To engage in independent investigations of mathematics topics from the middle school curriculum or from mathematics appropriate for that level.
- To communicate mathematics ideas arising from technology-enhanced investigations.

Goal 3: Support reform of mathematics teaching and learning in middle grades mathematics classrooms.

- To enable middle grade mathematics teachers to develop and adapt materials and goals from standards-based curriculum through the use of technology.
- To model and explore collaborative instructional strategies.
- To develop mechanisms and expectations of sharing instructional ideas, materials, and information among middle school mathematics teachers.
- To support comprehensive standards-based middle school mathematics curricula and the implementation of Quality Core Curriculum and NCTM goals.
- To utilize technology tools in the implementation of alternative assessment strategies.

Goal 4: Establish the human and technological infrastructure needed to sustain meaningful reform of middle grade mathematics instruction.

- To develop confidence in technology use as teachers explore, practice, reflect, and become adept in technology-enhanced teaching and learning of mathematics
- To enable and encourage middle school mathematics teachers to collaborate by using technology support.
- To support professional development opportunities for middle school mathematics teachers and other key personnel through a network of peer teachers.

## **Professional Development**

### **Workshop Procedures**

The workshops are intended to immerse teachers in active problem solving with technology. Participants will explore different concepts each class meeting by working through various InterMath investigations and writing about one in-depth. Each participant will build a personal web page using artifacts and productions from the workshops to compile an electronic portfolio. Write-ups and projects, reflecting participants' synthesis and reflection about their explorations, will be submitted electronically for workshop credit. The purpose and focus of a write-up is to communicate and synthesize investigations involving exploration, solving a problem, or working with an application. The key elements of a write-up consist of the learner's synthesis, communication, mathematical ideas, interpretation, and utility of an investigation. Final projects, focusing on a technology-enhanced mathematics investigation of the

individual participant's determination, will be submitted and discussed at the end of the workshop/laboratory. Participant productions will be placed on the web page for public sharing.

The laboratory leader will present demonstrations and explanations, clarify problems, and demonstrate alternative solutions using a projected image from the leader's workstation. In a typical session, a leader might allocate one-third of the time in whole-group mode, and during the balance of the meeting provide direct support for participants working on their projects or units, either individually or in groups. The InterMath web site (<http://www.intermath-uga.gatech.edu/>) will enable participants to work at their home or school sites.

In addition to the 45-hour workshop, the 55-hour "follow-along" course will promote the use of technology to enhance mathematics teaching in their home school and to extend each participant's expertise. This additional component to the workshop promotes reflective practice among the participants, emphasizing realistic applications of technology in middle school teaching. Each participant's web page contributions will include conceptual work, projects, activities for their classroom, and links to related teaching-learning resources in order to establish a highly connected framework of resources.

### **Participant Selection and Credit**

Participation will be open to all middle school educators in Georgia, but teachers from historically underserved schools will receive top priority. Applications will be solicited from schools located within the service areas of the participating sites (First year: University of Georgia, Kennesaw State University, and Valdosta State University).

It is expected that a team of selected teachers will participate in the workshops and at least one administrator will participate in a minimum of 20 hours of professional development as part of the team. It is also imperative that each teacher member has classroom Internet access and there is e-mail access for all team members. Teams with a minimum of one teacher of mathematics from each grade level (4-8) represented in the school will receive priority in the selection process.

Credit could be in the form of graduate hours or staff development units depending on the institution offering the workshop. InterMath participants need to check with the site at which they will be participating to determine what type of credit they will receive. If graduate credit will be offered, participants will likely have to apply and be admitted to the graduate school at that particular institution.

### **Administrative Support**

Administrative support and leadership are key in both promoting and sustaining school innovation. Several authorities advocate models that tie professional development to a particular school and are explicitly linked to reform activities that the individual school is undertaking (Darling-Hammond, 1995; Davis & Padilla, 1991; Lieberman, 1995). Therefore, administrative support in school improvement plans influences teacher and student use of technology. The target administrators for InterMath are building level personnel with primary responsibility for instructional leadership, i.e., principals, assistant principals, instructional specialists. However, central office administrators with responsibility for curriculum design, professional development, student assessment and the support of instructional technology are also encouraged to participate in the InterMath program.

In the InterMath workshops, administrators will engage in hands-on activities using the Internet to support teachers in their efforts. This participation will ensure that administrators better understand the power and potential of the learning activities, the technical needs of the teacher, and the classroom management techniques that complement technology-enhanced learning experiences. Administrators will be encouraged to share their ideas, problems, solutions, and successes for supporting their teachers. Thus, InterMath workshops can provide a forum to reduce administrator isolation and support administrators in follow-up activities including instructional leadership and teacher evaluation.

## **Our Use of Technology**

The InterMath workshop intends to illustrate *how* and *when* technology can be used appropriately in the mathematics classroom. The literature describes two distinctly different approaches in the use of technology in classrooms: using the computer as a tool for exploration or problem solving and using the computer as a tutor that delivers instruction and provides feedback. Research on the use of computers in mathematics as a tutor and a tutee are usually not situated in problem solving environments. Most tutor-based technologies are in the form of drill and practice software, which tend to rely on lower ordered skills, and are often negatively related with student achievement (Jonassen & Reeves, 1996; Wenglinsky, 1998). Jonassen and Reeves (1996) argued that higher-order thinking occurs in environments where the student is learning with, and not from, the computer. It is this approach that InterMath promotes and intends to develop among its participants.

Many studies investigating technology-enhanced environments include an emphasis on conceptual development situations. For example, when calculators and computer software perform calculations and simplifications, teachers have more time to emphasize why something is happening, instead of focusing on algorithms (Grassl & Mingus, 1997; Heid, 1988; Maury, 1987; Palmiter, 1991). Moreover, the imperfections in calculator graphs and computations also provide opportunities for conceptual development. For example, Dion (1990) found cases where the graphing calculators' resolution caused certain functions to appear differently than they are supposed to. In addition, Goldenberg (1998) found that the graphing calculator window can provoke critical inquiry because different functions can appear to look the same if they are on different domain and range windows. Finally, Burrill (1992) noticed that the calculator has difficulty simplifying computations with extremely large and small numbers, consequently producing an incorrect answer. Used appropriately, these situations expose misconceptions and help students develop a richer understanding of the mathematics being studied.

## **Technology Applications and Facilities**

The technologies used in the InterMath program range from low-end, hand-held calculators through high-end multimedia workstations. Computer software applications including spreadsheets, graphing tools, dynamic geometry, web editing, and Internet will be used regularly throughout the workshops. Technology will be available and supported both at INTECH sites and in the participants' schools. All INTECH labs have high-speed Internet access to support individual workstation, local network, and web-based mathematics activities and applications. The laboratory also affords ready access to non-computer technologies, including graphing calculators and manipulative materials.

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## **Cognitive Development**

### **Rationale of Workshop Activities**

In designing the workshops, we have kept in mind the work of Malone and Lepper (1987) concerning the design of instructional environments that are intrinsically motivating. They have identified four sources of intrinsic motivation in learning activities: (1) gives an appropriate level of challenge, (2) appeals to the sense of curiosity, (3) provides the learner with a sense of control, and (4) encourages the learner to be involved in a world of fantasy in which learners can experience vicariously rewards and satisfactions that might not be available to them otherwise. While a workshop leader may not be able to incorporate all of these sources of intrinsic motivation into every learning activity, incorporating at least one appears to increase the likelihood that the activity will be intrinsically motivating.

Pertaining to the first source of intrinsic motivation, we have included a variety of problems on a continuum of difficulty levels. By posing challenging problems within a familiar context, teachers will develop confidence in problem solving and thus will more likely engage in the activities. The context of the problems enables teachers to safely sample and reflect on their own approaches to problem solving. The second source of intrinsic motivation is appealing to the sense of curiosity. Activities can stimulate curiosity by introducing ideas that are surprising or discrepant from the learner's existing beliefs and ideas. While the mathematical problems posed in the laboratories will center on middle-school curriculum, they

are more open-ended and generative than is typically seen in a traditional middle-school curriculum. Problems can be used as a springboard for ideas and investigations that participants find personally intriguing. Furthermore, teachers will be able to choose among several activities in which to actually engage. They can choose activities that are most applicable to their classroom needs and relevant to their mathematical understanding. Since participants can choose activities based on their preferences, the third source of intrinsic motivation (providing the learner with a sense of control) will be reflected throughout the laboratory.

The fourth source of intrinsic motivation is encouraging engagement through fantasy. As an example of a task using fantasy, consider the following problem requiring the use of the Pythagorean theorem:

The learner needs to calculate the distance from point  $a$  to point  $b$  in order to inform Captain James T. Kirk about how to set the transporter beam on the Federation Starship *Enterprise* so they can pick up the necessary dilithium crystals directly below on the planet's surface. Kirk only knows the distances of the ship and the crystals from a third point where his scouting party has stopped (Lepper & Hodell, 1980).

Fantasies are more intrinsically motivating when they employ characters and situations with which the learner can identify. Faced with either this fantasy-like problem or a series of abstract problems in which learners are asked to find the length of one side of a triangle, one can imagine which type of problem learners would prefer.

The philosophy permeating InterMath is that teachers must relearn mathematics in a more open-ended, generative manner so they may come to understand what reform documents intend by "meaningful learning." Furthermore, by encouraging teachers to create and modify their own curriculum units, InterMath attempts to avoid what Howson, et al. (1981) warn may be a cause for failed reform -- teachers failing to assume ownership of reform.

### **Workshop Content**

The mathematics content and concepts of InterMath reflect curriculum that would enhance a teacher's understanding of middle-grades mathematics. The laboratory centers on the middle-school mathematics curriculum per Georgia's [Quality Core Curriculum](#) (QCC) and the [NCTM Standards](#) (1989, 2000). The InterMath curriculum is meant to engage teachers and is intended to deepen teachers' understanding of mathematical concepts related to the middle school curriculum. Thus, the investigations would likely need to be modified for use with middle school students.

There are 14 units that can be used for InterMath workshops. Thirteen units are called Fraction and Decimals, Integers; Ratios, Proportions & Percents; Quadrilaterals, Triangles, Polygons, Probability, Statistics, Solids, Circles, Graphs, Patterns, Functions & Equations. The fourteenth unit is comprised of over 200 problems adapted from *Teaching Mathematics in the Middle School* (NCTM). The following criteria have been used to highlight recommended investigations for teacher exploration:

- Multiple cases can be investigated using technology.
- Pre-Algebra students can rely on technology to investigate the situation.
- The investigation promotes generalizability or can be used as a springboard for further exploration.
- Multiple methods can be used to explore the situation.
- Multiple solutions are possible.
- The investigation, based on middle school mathematics, is easy to start exploring.
- The investigation can be modified for use in a middle school classroom.

The following investigation exemplifies these principles:

Choose two numbers. Add them together and form a [Fibonacci-like sequence](#), starting with your first two numbers, and ending with a total of ten numbers. For example, if your first two numbers are 3 and 5, then your third number is 8 ( $3+5$ ), your fourth number is 13 ( $8+5$ ), your fifth number is 21 ( $8+13$ ), and so on. Determine a relationship using the seventh term and sum of the terms of your sequence. Is this true for *every* sequence of this nature? Explain.

- Multiple cases can be investigated using technology.  
The use of formulas in a spreadsheet allows teachers to change the initial two numbers and instantly view calculations of the remaining 8 terms and the sum of the sequence. As multiple cases are tested, a formula relating the seventh term and sum of the sequence can be hypothesized, tested, and modified.
- Pre-Algebra students can rely on technology to investigate the situation.  
While students can conceivably make a reasonable conjecture about this investigation using a few cases, they will need an algebraic proof to verify that their conjecture is true. The use of technology in this case amplifies the confidence in their conjecture because multiple cases can be tested.
- The investigation promotes generalizability or can be used as a springboard for further exploration.  
Following the experimentation process with technology, teachers are encouraged to question why a particular pattern develops and then investigate a proof. Furthermore, after answering the initial question, teachers may develop further questions, such as:
  1. Will this hypothesis be true for negative numbers?
  2. Will this hypothesis be true for decimals and fractions?
  3. Are there relationships between the sum and other terms in the sequence?
- Multiple methods can be used to explore the situation.  
A spreadsheet can be used in a variety of different ways to investigate this situation. For example, students can construct one table that continually changes, or a grid with multiple tables. In addition to spreadsheets, symbolic manipulation can be used to investigate this problem.
- Multiple solutions are possible.  
Many people will propose that 11 times the 7<sup>th</sup> term will equal the sum of the sequence. In addition, multiple linear combinations are also acceptable, such as six times the 7<sup>th</sup> term plus 2 times the 9<sup>th</sup> term minus the 4<sup>th</sup> term will equal the sum of the sequence.
- The investigation, based on middle school mathematics, is easy to start exploring.  
Only basic arithmetic operations are used in this investigation. Most people begin using positive integers in their exploration, and then later broaden their scope to different types of numbers such as negative integers, fractions, decimals, and irrational numbers.
- The investigation can be modified for use in a middle school classroom.  
This investigation can be immediately adopted in the middle school classroom if the intention is to teach pattern recognition and creation of formulas from data. However, a shorter sequence might be used in the classroom if the teacher intends to illustrate adding like terms, using the distributive property, and creating linear combinations with variable expressions.

## Next Steps

InterMath is in its second year of a five year project. Over the past year, the web-based InterMath materials have been developed and tested with various teachers in the state of Georgia. This year the project will run workshops in the spring and summer semesters to build a community of teachers that will develop technology-enhanced materials for their classrooms. In addition, we intend to develop an ongoing support system that will encourage a sustained effort among teachers in the InterMath program. The goal

at the end of the five year project is to have a self-sustaining system of resources, tools, and people with a common goal of enhancing mathematics education using technology as a catalyst for change.

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