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Preface

For the twenty-fourth year, the Research and Theory Division of the Association for Educational Communications and Technology (AECT) is sponsoring the publication of these Proceedings. 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 in both hardcopy and electronic versions. It is also available on microfiche through the Educational Resources Clearinghouse (ERIC) system.

The Proceedings of AECT's Convention are published in two volumes. Volume #1 contains papers dealing primarily with research and development topics. Papers dealing with instruction and training issues are contained in volume #2, 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.

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Web Usability Test Findings and Analysis Issues

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Abstract

In this paper, we discuss findings and data analysis issues that resulted from a case usability test. The findings relate to the generation of design ideas. Through usability test, it was found that users have a somewhat unified viewpoint regarding the menus on the side areas of a web page. They tend to view them as a "quick" way to access "specific" and "frequently searched" information. The analysis issues are concerned with analyzing task completion rate, time taken, and path taken to finish the tasks. When analyzing these measures, the researcher needs to consider nature of the web site, portal site in this case usability test, rather than simply looking at whether and how the test participants found the answer.

Introduction

This paper discusses findings and analysis issues derived from a lab usability test. The procedure of conducting a lab usability test is pretty much standardized and there are standard sets of data typically collected in web site tests such as, task completion rate, time taken, paths taken, and verbal protocol. The analysis of the data, however, varies widely depending on the case. When analyzing usability test data, it is important to consider the nature of the web site. Depending on the nature of the site, the same data can be analyzed differently resulting in different usability indices. In addition, it is well-known in the usability literature that deriving design ideas from usability test data is a difficult task. Generating design ideas is closely related to how the researcher analyzes test data. This paper describes and discusses how a web design team considered the nature of the portal site in data analysis and derived design ideas by distilling data into a finding and the finding into design ideas.

Redesign of a University Web Site

The case usability test this paper derives data from was conducted as a part of redesign project that aimed to update the existing home page of Indiana University Bloomington (IUB) [2]. The home page contained links to the web sites that various institutions in the university had already created. Therefore, it functioned as a portal to various web sites and employed hierarchical menu structure.

It was acknowledged that the site had a high degree of usability because a group of graduate students in the university conducted a user-centered design research and applied the research results when designing the site in 1995 [1]. Although usable, there occurred several reasons to redesign the site. First of all, it was reported that prospective students look at universities' home pages a lot when they consider applying for schools. Keeping the site up-to-date was important in the view of the university's marketing strategy. In addition, information organization of the site was getting messy as the site was accommodating publication requests from various institutions in the university over the years. For example, some pages had too many links and some links were not placed in the page where users would expect to see them. Finally, there has been a consistent request that the site should enhance its visual aspects. With these reasons, IUB Web team began a redesign project in January, 2000 with an emphasis on user-centered design principle.

As the first step of the redesign effort, the design team created a preliminary prototype outlining link categorization only and tested usability of the link categorization. Then, the team produced second prototype where they incorporated results of the usability test and included visual elements. Although the link categorization was assumed to be usable, the team conducted another bigger scale usability evaluation on the second prototype to ensure usability of the overall prototype. Usability evaluation on the second prototype had various goals. In addition to collecting general usability measures such as task completion rate, time taken to complete the tasks, and the links chosen to complete the tasks, the evaluation aimed to measure effectiveness of new navigation features and hear users' opinion about the site in general and visual design in specific. It also targeted to assess accessibility and speed of the site. To achieve such various goals, it was necessary to use various test methods such as a lab usability test, heuristics evaluations, a web-based survey, foreign font display check, and page loading speed check.

Lab Usability Test

The findings and analysis issues discussed in this paper resulted mainly from the lab usability test. The lab test employed typical usability test methodology. Participants were selected through purposeful sampling. Nine users of the current IUB home page were recruited as test participants considering their occupation, web use, gender, and nationality. In the test, the participants were asked to perform eleven tasks using either the new prototype or the existing web site. Through random assignment, participants 1, 3, 4, 5, and 9 were asked to use the new prototype, whereas 2, 6, 7, and 8, the existing site. Through the eleven tasks, participants were asked to search for typically and frequently searched information in IUB site. The tasks also required the participants to use new navigational features and menu structures. Throughout the test, participants were asked to think out loud. The test administrator observed the test session collecting performance measures such as task completion, time taken, and paths taken as well as the participants' comments and emotional expressions. She sometimes prompted and probed think-aloud, and responded to the user's task-related questions. The whole test sessions were videotaped for later review. After the usability test, a debriefing interview was conducted. The test administrator solicited further comments about the events during the test that she did not understand. In addition, she asked for comments about the web site in general and any suggestions for improvement.

Data Analysis Considering Nature of the Portal Site

Task completion rate, time taken, and paths chosen to complete the tasks are three classical usability measures. Typically, successful completion is considered to be the point when the participant finds the answer. The time taken and the links chosen till the completion point are typically analyzed. Such typical way of analysis, however, didn't seem to work well in the IUB web site test. As the target site of the test was a portal site providing links to various external web sites, it was inevitable for the participants to use sites other than the target site (i.e., external sites) in order to finish the tasks. Indeed, some users spent much time looking at external pages. Some failed to find the answers due to the design problems of the external sites. Simply looking at whether the participant had found the answer or not, and counting total time taken didn't seem to be appropriate measurements. After several rounds of discussion, the team decided to make a distinction between the use of IUB home pages and the use of other sites and collect the three measures during the use of IUB home pages only.

Task Completion

In the case of task completion rate, the team decided to consider that a participant completed a task successfully if she found the link leading to the external site containing the answer (i.e., correct link), regardless she found the answer or not. The fact that the user had found the correct link was assumed to indicate that the link categorization in IUB site was effective enough for the user to get to the right place, which was the main goal of the site. If the user failed to find the answer after getting to the correct page, it was due to the poor design of the external page, which was beyond the goal of the re-design project. Table 2.1 summarizes task completion rate following this analysis decision. If the user found the correct page but failed to find the answer, it was indicated as f/s and counted as a success rather than a fail. Table 2.2 summarizes task completion rate by just considering whether the user found the answer or not. Note the difference in the number of people completed the task successfully between the two tables. T test result on the difference was t = 1.884, df=10, p=.089. Considering small sample size, the difference was almost significant.

<Table 2.1> Task completion rate considering the use of IUB site only

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
s1	s	s	s	s	s	s	s	f /s	s	s	s
s3	s	s	s	s	s	s	s	f /s	s	s	s
s4	s	s	f /s	s	f	f /s	s	f	s	s	s
s5	s	s	f /s	s	s	s	s	f	s	s	s
s9	s	s	f /s	s	s	f /s	s	f	s	s	s
No. of people completed the task successfully	5	5	5	5	4	5	5	2	5	5	5

s: success
f: fail
f/s: the user found the correct page but could not find the information due to the poor design of external sites

<Table 2.2> Task completion rate considering the use of not only IUB site but also external site

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
s1	s	s	s	s	s	s	s	f	S	s	s
s3	s	s	s	s	s	s	s	f	S	s	s
s4	s	s	f	s	f	f	s	f	S	s	s
s5	s	s	f	s	s	s	s	f	S	s	s
s9	s	s	f	s	s	f	s	f	S	s	s
No. of people completed the task successfully	5	5	2	5	4	3	5	0	5	5	5

Time Taken

In the case of the time taken to finish the tasks, the team decided to count the time spent before the users found the correct external site for the first time. Here, the word "for the first time" is important because several occasions occurred where users found the correct external site initially but could not find the answer in the site. Then, they went back to IUB site, tried other external sites, and went back to the correct site which they looked at previously and found the answer eventually. In this case, the time taken to find the correct external site for the first time seemed to be an accurate measure of the effectiveness of the link categorization. Table 3.1 summarizes time taken to find the correct external page for the first time whereas Table 3.2, total time taken to finish the tasks. The mean time taken is significantly (t= -4.318, df=10, p=.002) different depending on the two different ways of counting time.

<Table 3.1> Time taken to find the correct external page for the first time (in second)

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
s1	105	18	134	13	9	122	26	108	48	29	13
s3	157	35	47	8	16	226	109	157	7	13	36
s4	110	27	54	37	fail	47	103	fail	44	15	40
s5	10	22	36	7	48	26	26	fail	19	41	19
s9	31	135	16	19	33	38	112	fail	3	8	5
Mean time taken	82.60	47.40	57.40	16.80	26.50	91.80	75.20	132.50	24.20	21.20	22.60

<Table 3.2> Total time taken to find the answer (in second)

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
s1	135	312	702	45	36	300	242	620	109	35	121
s3	310	253	238	27	34	523	138	332	25	19	102
s4	430	122	420	58	fail	501	243	fail	136	35	311
s5	134	121	331	115	100	40	59	fail	109	44	126
s9	49	428	656	239	201	534	219	fail	10	16	300
Mean time taken	211.60	247.20	469.40	96.80	92.75	379.60	180.20	476.00	77.80	29.80	192.00

Paths

When analyzing the links the participants have chosen till they find the answer (i.e., path taken), it is difficult to derive general currency due to the wide variety of the links people usually choose. It is often possible to analyze how many people followed the ideal thread of links and how many did not, or what links in the ideal thread people did not choose correctly. Such analysis provides the design team with a general evaluation on the effectiveness of the link categorization. However, they do not render much design ideas, other than the requirement to re-place a few links that people did not choose correctly in an ad hoc manner.

The team sought out a more systematic way to utilize the path data and found out that a rich set of design ideas could emerge by summarizing the first link the participants chose to complete each task. Table 1 summarizes the first link participants chose to complete the tasks in the IUB site test. Almost all participants chose the same link to perform tasks 2, 4, 5, and 9. To perform tasks 1, 7, 8, and 10, participants chose more than one link however there was one link that majority of the participants (i.e., three out of five) chose. For example, to perform task 7, three out of five users chose “ss” as the first link whereas two users chose different links. For tasks 3, 6, and 11, people chose three different links and there was no particular link most participants chose.

<Table 1> First link participants chose to complete each task

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11
s1	pg	aa	vc	vc	ae	cne	cne	ar	aa	lc	ss
s3	pg	aa	ss	vc	ae	cne	adm	ar	aa	lc	ss
s4	aa	aa	ss	cne	cne	pg	ss	ar	aa	lc	lc
s5	gs	aa	adm	vc	ae	ss	ss	ss	aa	pg	lc
s9	pg	ss	vc	vc	ae	pg	ss	ss	hta	ee	ch
Link variability	3	2	3	2	2	3	3	2	2	3	3

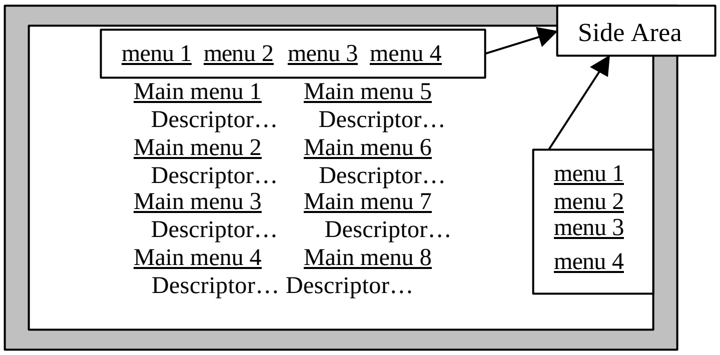
Note: Link names are abbreviated. E.g.) "pg" is "people & groups" and "ss" is "student services."

By examining the degree of variability in the choice of the first link, the team could generate design ideas. The data indicated that information related to the tasks 2, 4, 5, and 9 were categorized intuitively enough for most people to select correct entry point. On the contrary, those related to 3, 6, and 11 were not. Therefore, information related to the tasks 3, 6, and 11 needed to be either labeled better or placed in a more appropriate link hierarchy. The data also gave ideas as to where to put certain information. For example, the data clearly indicated that users expected to find information related to the task 8 either in "ar" or "ss" page. Unfortunately, the prototype did not provide that information in either of the pages.

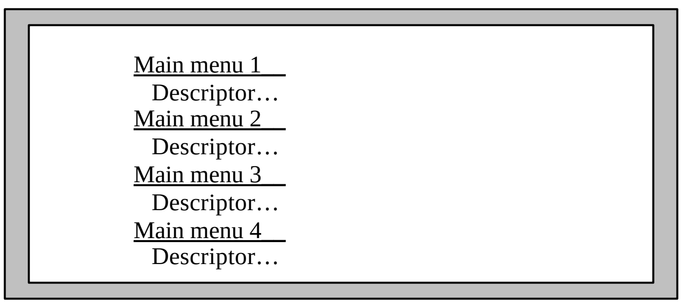
Deriving Design Ideas On Side Menus

The first level page of the IUB site contained ten main menus and each menu had three descriptors underneath. In addition to the main menus, the page included more items on the right-hand side and the upper part of the page, which the design team called "side menus." The existing web site did not have side menus. Figure 1 and 2 depict such difference in the menu structure of the first level page between the new prototype and the existing site.

<Figure 1> First level page's menu structure in the new prototype



<Figure 2> > First level page's menu structure in the existing site



The idea of having side menus in addition to main menus arose from the team's desire to maximize the use of screen space. There have been research articles reporting that some people do not scroll down while they browse menus on the page. In addition, researchers like Jakob Nielsen have been arguing for the breath of menu over the depth.

Initially, the team did not have a clear understanding about the nature of the menus appropriate to each group of the menus. Through usability tests and interviews with test participants, however, it was found out that users had a certain and unified viewpoint on the side menus. They tended to view them as a "quick" way to access "specific" and "frequently searched" information. The specific and frequently searched information are the ones highly identifiable to most users of the site. In the case of a university web site, access points to e-mail system, grading system, or commonly used knowledge base are some examples. This finding derived from the interviews and the observations of the paths test participants took while performing the tasks. Firstly, participants requested that the information presented through the side menus should be replicated somewhere in the main menus. They wanted to be sure that the information was available to them even if they would ignore the side menus entirely. This indicated that the main function of the side menus was a way to access certain information quickly rather than a primary provider of information. Secondly, the prototype subjected to the usability test had a couple of side menus whose nature was somewhat general such as "how to apply" and "computing help." To find admission and computer help information, participants used main menus rather than side menus because, they didn't know what specific information they needed to find out yet and wanted to ensure they were browsing comprehensive list of information available in the site. This indicated that the information presented through the side menus should be specific.

Having identified the nature of information appropriate for the side menus, the design team then discussed kinds of information and a naming strategy appropriate for the side menus. By examining keyword search statistics of the existing IUB site, the team found out that three most specific and frequently searched items were e-mail, INSITE, and Knowledge Base. INSITE was a student service system through which students could view or update their address, class schedules, grades, tuition and fee bills, etc. Knowledge Base was a database of university computing help. As for the menu names, the team adopted the actual names of the systems. The general public might not understand what the names meant however people belonging to the community would understand them. Since the side menus were frequently searched information, targeting people belonging to the community seemed to be appropriate.

Conclusion

Analyzing usability test data to fulfill true purpose of the usability test is not always straightforward. Design teams conduct usability tests usually to measure the degree of usability of their design (i.e., usability indices) and gather ideas for improvement (i.e., design ideas.) This paper described how IUB web team analyzed test data to meet such purposes. In conclusion, it is important to consider nature of the design when analyzing test data. In addition, the process of distilling findings from data and linking the findings to design ideas is an important part of analysis.

References

Frick, T., Corry, M., Hansen, L., & Maynes, B. (1995). Design-Research for the Indiana University Bloomington World Wide Web: the "Limestone Pages", [Online]. Available: http://education.indiana.edu/ist/faculty/iuwebrep.htmlIndiana University. Homepage of the Indiana University, [Online]. Available: http://www.indiana.edu

A Study on Describing the Field Identity of Educational Communications in Turkey

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Abstract

Although educational communications has been accepted as an independent field of study for nearly 40 years, there is still no agreement on its conceptual definition and boundaries in Turkey.

This study was conducted by using the literature, and the experts' opinions to describe the field identity of educational communications. The researchers contributing to theoretical development of the field and practitioners developing products of educational communications in Turkey were selected to form the expert panel. Then, a three-stage Delphi technique was used to collect opinions of experts who have been geographically dispersed and hard to bring together. Data about the experts' opinions on both the different aspects of educational communications and the structure of the questionnaire were collected.

The study has shown that opinions of the researchers and practitioners on these competencies, issues, and trends are similar except the "describing and introducing the field" category, and a few of the items. In the further analysis of the data, 16 professional competencies, 10 current issues, and 19 future trends were identified.

Introduction

The term "educational communications" is used to refer a field of study derived from the efforts of solving problems and needs of human beings about learning through developing technologies by using theories and principles of many other fields. In other words, educational communications is another name for the field of educational technology. Due to long history of educational television, the term "educational communications" has been used instead of educational technology for years. Thus, educational communications is used through out this paper.

Although educational communications has been accepted as an independent field of study for more than 40 years, there have always been many discussions and disagreements on its conceptual definition and boundaries (Hackbarth, 1996; Heinick, 1984). According to Seattler (1990) it looks like these conflicts will always be.

This situation causes difficulties for introducing the field to people working in other fields as well as new comers. It also grounds problems in coordination between research and practice in the field. These problems are experienced more intensely in Turkey because of diverse interpretations of the field.

However, in order to improve and extend the acceptance as a mature field of study, these sorts of problems must be overcome. By overcoming these sorts of problems in a field, theoretical supports might be provided to the practices, instructional programs and research studies might be directed, people working in the field might improve themselves, decisions that might be effective future directions of the field can be supported, and the field might be introduced to the others and new comers (Marriner, 1989).

Unfortunately there is almost no or a few study on either describing the field identity of educational communications or establishing a consensus on the definition and boundaries of the field. The first and one of the significant works was Alkan's philosophical thoughts about use of technology in education, which was completed in 1977. Since this work several significant works such as Çilenti (1983), Güler (1990), Barkan (1994) have also done. But all of them are based on translations and interpretations of foreign researchers' works and represent their personal views. So that, almost all define the field where they stand from and this situation cause conflicting problems.

In addition, multitude of variables influencing the field and mobile nature of the field make harder to come a consensus on different aspects of the field, too.

Another important reasons of having no agreement on the aspects of the field might be that there are very few people work directly educational communications. Most of these people are separated geographically and hard to bring them together.

Delphi technique is one of the useful applications for group decision-making without face-to-face interaction. The major idea beneath this technique is that "more heads are better than one". Delphi technique is described as "… an anonymous, independent, noncompetitive survey of experts to obtain consensus without necessarily involving group meetings. The technique essentially entails a series of surveys using the same experts, each survey dependent upon the responses of the previous one" (Jonassen, Hannum, & Tessmer, 1989). Although its several limitations, Delphi technique has been used for many years for especially group decision-making and future predictions.

Statement of Purpose

This study purposes to determine different aspects of educational communications such as theoretical backgrounds, research topics, emphasis areas, roles and competencies, major issues and problems, future direction; therefore, it was intended to clarify the field identity of educational communications. Sp ecifically, the following research questions were addressed:

What kinds of phenomena have been effective on evolution of the field?
What are the emphasis areas and research topics in the field?
What are the competencies of experts of educational communications?
What are the major problems, issues and future directions in the field?

Method

Since this study requires group decision-making and future predictions, Delphi technique has been chosen for especially judgmental data collection. In addition to Delphi, theoretical works and research studies of foreign experts are also used for particularly phenomenal data collection.

Participants

This investigation was conducted with two experts groups. We hoped that our results would be of interest to academicians who either conducted research or published a distinguished work (paper, book, etc.) to contribute the body of scientific knowledge in educational communications and corporate trainers who are experts work in either a private or public sector organization and design, develop, evaluate, manage instructional activities.

It was intended to reach out the whole population since there are a few people working in the field. Fifty (5) participants involved in Phase 1, but only thirty (30) of them managed to complete Phase 3. Half of these participants were researchers (all academicians) and others were practitioners (all corporate trainers). Most of the participants who dropped the investigation were practitioners.

Instrument and Treatment

The Delphi instrument unfolded in three phases. Phase 1 consisted of an introductory letter and a request for participants to assist in offering the aspects of the field worth for investigating. In addition to these instruments conversations were conducted mostly through telephone calls. Submitted statements were compiled, analyzed to identify the aspects of educational communications for investigating. As a result of this phase 10 aspects were identified among the offered ones: History, definition, theoretical foundations, research topics, emphasis areas, experts' roles and competencies, instructional programs, major issues and problems, future trends and directions, process of educational communications.

After having conducted a literature review, we determined 143 statements and developed a Likert type questionnaire including these statements for Phase 2. In Phase 2 of the study, this questionnaire was sent to each respondent of Phase 1, it was asked each person to rate each of the 143 statements as to how strongly they anticipated the statement. In the Likert type questionnaire the Endpoint 1 was to indicate that the participants strongly disagree the statement, and Endpoint 5 to indicate that the participants strongly agree the statement. Also it was provided to indicate their thoughts on the overall structure of the questionnaire.

After reaching expected return rate (17 for each group), we analyzed the data and concluded that most of these statements were phenomenal data and required no further investigation. In other words, the participants indicated that these must be accepted as they are so that they must not be included into the questionnaire. These statements were excluded from the questionnaire owing to the consistency with the literature. As a result this Phase, 143 discrete statements was reduced to 70 and these were categorized into three groups: competencies, problems, and trends.

In Phase 3, the last version of the questionnaire sent to the determined participants of Phase 1. Unfortunately the ones did not respond the Phase 1 and Phase 2 repeated their attitudes about responding even though we reach most of them through phone and requested to respond. After receiving 15 responds for each group, the data analyzed.

Through this three-phased Delphi study both a new standard questionnaire developed and experts' viewpoints were integrated.

Results

In Phase 3, we calculated the mean score on all items to be 3,87, with a standard deviation of .43. These and frequency of scores, in general terms, indicate that the average score on the 70 items leaned toward an agreement –but not a strong one- side of the scale. Also it can be observed that there is not a big variation among all participants' responses. When the two groups of researchers and practitioners were compared, it was found that the researchers were not only more agreed on the statements than practitioners (mean scores of 4.0 versus 3.73) but they also show a few variations in their responses as shown by the decrease in standard deviation (.028 versus 0.52) (Table 1).

Table 1: Means and Standard Deviation of Groups

Groups	Item Mean Score	Standard Deviation
Researchers	4.00	0.28
Practitioners	3.73	0.52
Total	3.87	0.43

The analysis of the results revealed that participants rated 38 of 70 items with mean scores higher than 3.87. This finding might be interpreted as that there is a strong agreement on these statements related to the field.

It was also compared the items rated by the researchers with those rated by the practitioners. An analysis by t test of non-independent items yielded a statistically significant difference on 11 of the 70 items between the two groups at or below an alpha level of .05. Except one of the item, related to the trend about decrease in research studies, in all other cases, researchers rated the items to be more agreed than practitioners.

Discussions

The results reached in this investigation are given below into four groups according to the research questions.

Phenomena Influence the Evolution of the Field

This part heavily depends on phenomenal data collected from literature. The literature review shown that the term "educational communications" refer to a field of study derived from the efforts of solving problems and needs of human beings about learning through developing technologies by using theories and principles of many other fields. The roots of the field can be traced back to the works of Comenius. Educational communications was considered as a movement until the mid 1960s and then it has accepted as a field of scientific study. During the period of being considered as a movement, it was focused on the effective presentations of the content with an instructor and the audio-visual aids. During 1950s, with the influences of communication, system and particularly learning theories, the focus shifted on development of instructional materials and transferring learning theories into instructional activities. The previous focus rooted the educational media emphasis area and latter leaded the development of instructional design models and theories (Ely, 1996).

Most of the current practices and research studies are related to the instructional design. The results of Delphi show that the highest means scores observed on statements related to instructional design. In this context, it might be claimed that the investigation supports the idea that instructional design has a significant role in educational communications.

On the other hand, literature reveals that with the influence of constructivist approach, most of the educational communication efforts changed toward design or organization of learning environments where learners learn through interacting with authentic contexts (Winn & Snyder, 1996). During the Delphi investigations all participants agreed on the items related to this issue; therefore, this can be considered as an indicator of support of this study to the literature.

Emphasis Areas and Research

This part also depends on phenomenal data collected from literature. Research studies show us the topics that educational communication specialists are dealing with (Thompson, Simonson & Hargrave, 1996). Some of the variables are motivation, transfer, learning context, feedback, learning strategies, learning styles, attention focusing, confidence, time-on-task, retention. Experts use these sorts of variables to design effective, efficient, and appealing learning environments. This also supports the definition of educational communications, which refer to a field of study derived from the efforts of solving problems and needs of human beings about learning through developing technologies by using theories and principles of many other fields.

On the other hand, there are so many emphasis areas in the field. But, this might display the field too broad and unorganized, and might make harder to clarify the theoretical boundaries of the field. In order to eliminate these dangers, provide leadership for the studies, and make the introduction of the field easier, there might be a need for categorizing the emphasis areas.

Thus, we categorized all areas into three major emphasis areas after having examined the research studies, practices, developments and trends of the field. These are (a) instructional design, (b) educational media, and (c) human resources development. The items included in the questionnaire are falling into one of these areas. This situation supports this categorization of emphasis areas.

Competencies

There are several sources about the competencies of educational communication specialists in the literature. By using these sources and views of experts 31 competencies were determined. However after having a detailed investigation, we have decided to combine related ones so that we could manage to lessen the number of competencies. As a result of these efforts, 16 major competencies for educational communication specialist were concluded on. These competencies have shown similarity with the competencies determined for instructional designer by AECT and NSPI Task Force. These are:

- Analyze the needs
- Determine the projects appropriate for instructional design
- Describe the learner characteristics
- Analyze the characteristics of organizational environment
- Conduct task/content/job analysis
- Write performance objectives
- Develop achievement tests
- Sequence the objectives
- Select the instructional strategy
- Design the educational media
- Evaluate the outputs of education, instruction and training

- Design the management systems of learning
- Communicate verbally, visually and aurally
- Consult for the individual and career development
- Plan and monitor his/her own development
- Introduce educational communication field to the other and extend its applications

On the other hand, although instructional design is a well known and highly accepted emphasis area of educational communications all over the World, there are very few people have shown interest and worked in the this field in Turkey. Having no Turkish books on instructional design can also show how Turkish scholars pay attention to this area. However the Higher Education Council required an instructional design course for all the Computer Teaching and Instructional Technology undergraduate programs of education colleges but contents of most of these courses are far from instructional design and usually more related to the theories of teaching and learning. Only in Educational Communications and Planning Department of Anadolu University, several courses in varying levels (graduate, undergraduate) related to the instructional design such as "Introduction to Instructional Design, Instructional Design Models and Theories, Needs Assessment, Instructional Media Design have been offered since 1994. It is our hope that there will be more promising efforts to show the power and the importance of instructional design.

Major Problems and Future Directions

Based on the data collected form participants and the literature, 16 major problems identified and included the last version of the questionnaire. However, the results exposed that there is an agreement on only 6 of 16 items.

Among these 6 problems, the one related to the separation of evaluation as an individual field apart from the educational communications is interesting. It can be noticed in the literature that evaluation has been taken as a separate field of study for years but there is a tendency that claims that evaluation is one of the main parts of instructional design and cannot be regarded separate from this process. Results of the questionnaire demonstrate that there is a significant difference on this item between the groups. Researchers strongly believe in such a problem while practitioners are not sure about the existence of this problem. We interpret this as practitioners show more enthusiasm and pay more attention on evaluation today than they did in the past.

The item related to the research in the field is also interesting one. This item includes the idea that the attention in the field focuses much more on practice than research. Literature reveals the existence of such a problem (Gentry & Csete, 1991). However, the results of the questionnaire indicate that this is not a true statement anymore (mean score of 2.77). In other words the participants do not agree with this statement. Though there is a strong disagreement on this item between the groups. For only this item researchers did not supported the statement more strongly than practitioners (means scores of 2.40 versus 3.13). We interpreted this as an increase in research studies conducted during the recent years and because of this researchers believe that they do conduct more research now compare to they did in the past. In addition, parishioners are not able to follow these studies as good as researchers.

Another problem uncovered through this investigation is that an uncertainty about the theoretical boundaries of the field is still continuing. The main reason of this problem is the lack of enough research or other studies on this topic. Also having no professional organization and publication about the field of educational communications in Turkey supports this problem. The field usually is perceived as a field of study deals with bringing new technological tools into education. Because of this narrow view investments generally go to the production of new tools. The wide spread structure of the descriptive studies related to the field also supports the problem. This problem causes the diverse structure of instructional programs, misconceptions about the field and its place in the society, lack of relationship with other fields.

We concluded that the main reason under beneath most of these problems is lack of clarification of scope of the field. This main problem creates more problems. Also literature is full of same ideas on this problem (e.g. Gentry & Csete, 1991; Ely, 1995).

On the other hand, the last version of the questionnaire included 23 statements related to the future trends. Among all these statements, only for the one related to the being a leader in the educational changes is there a significant difference between the groups. Results indicate that practitioners are more suspicious than researcher about future the roles of the field in educational settings. The economic problems of the Country make graduates of the educational communication programs hard to find decent jobs. This situation might affect the responds of the participants, especially practitioners.

Participants also indicate that graduates of the programs will, sama as today, have almost no chance to be employed in public organizations such as ministry of education, etc. The economy experts are expressing the misuse of human resources in the governmental and public organizations, and harmfulness of this situation on economy. We think that if the graduates of educational communications could find opportunities to work in these organizations, there might be a slight chance to solve this misusage. One of the emphasis areas of the field is human resources development and the graduates have skills and attitudes toward correct usage of human resources.

Another interesting finding is that participants do not agree on the increase in distance education. This result conflicts with the literature. We interpret this as that although Turkey has a long history, this technology (distance education) is not accepted and it is not extended, as it has to be.

The results about the use of textbooks in the future is also interesting and conflicting with the literature. The participants agree on that the textbooks will still be used widely in almost all instructional settings although literature indicates a gradual decrease in use of textbooks. We think that use of very old-fashioned instructional approaches in almost every grade of public education and misleading applications of technology integration strengthen the idea that textbooks are the unique and most reliable sources of knowledge and increased the fear of technology usage.

On the other hand, results related to the statements about different aspects of instructional design such as increase in applications of constructivist approach, providing more learner control, wide spread use of team learning show consistency with the literature. However, applications prove that although experts believe in the importance of these applications, they find difficult to apply them in their instructions in Turkey.

Same as instructional design items, participants agree on the statements related to educational media such as development of virtual learning environments, use of digital technologies, wide speared use of computer networks. There is an increase in intensity of using web and other computer related opportunities for instructional purposes. When these practices are observed, it can be identified that most of these efforts have no pedagogical background and because of this they fail to help people learn. However, there is a tendency to include more and modern pedagogical aspects into instructional practices in Turkey.

Conclusions and Further Investigations

We strongly believe that the most important result of this study is that it is hard to draw strict boundaries of the field of educational communications due to its peripatetic nature and continues influences of the other fields. However, we propose that these sorts of decision-making and/or future prediction studies should be conducted regularly to keep up the developments in the field because fuzzy or conflicting ideas about the varying aspects of educational communications might create serious problems. Updated studies, for sure, will not only provide help for practitioners and researchers but also make leadership easier.

Turkey definitely needs more of these sorts of studies to be able to establish a consensus on different aspects of the field including names, programs, definitions, trends, applications, issues, etc. The first step might be a professional organization that will have the mission of providing leadership in the field in Turkey. So that publications and meetings can be supported easily to provide good communication channels among the people in the field, standard programs can be offered to bring up new people into the field, and demonstrate effective, efficient, appealing examples of educational communication practices.

In order to increase the validity and reliability of these sorts of research findings, researchers should include as many experts dealing with different aspects of the field such as employers of educational communication graduates and foreign experts as possible. So that new ideas might come up and stronger agreements might be achieved. However, Delphi technique is a time consuming activity. Most of the time usually spends for mailing and analyzing the responses but new technological tools provide researchers numerous advantages. E-mail is one of these advantages. E-mail based a Delphi study will of course save time. Also using some content analysis tools with e-mail might provide researchers flexibility of using different type of questionnaires such as the ones includes open-ended items.

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The Effects of MIMICing Instructional Theory with MIMIC (Multiple Intelligent Mentors Instructing Collaboratively), an Agent-Based Learning Environment

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Abstract

In this exploratory experimental study, 135 pre-service teachers developed an instructional plan for a case study within the MIMIC (Multiple Intelligent Mentors Instructing Collaboratively) computer-based environment. Three-dimensional, animated pedagogical computer agents, representing constructivist and instructivist approaches to instructional planning, served as instructional mentors within the environment and were available to provide suggestions. The research design was comprised of two two-factor MANOVAs with the instructivist agent (present, absent) and constructivist agent (present, absent) serving as the two factors, with two groups of dependent measures --awareness and attitude. Additionally, the value of the agents and overall differences between high and low performers were investigated. Regarding awareness, main effects for the presence of the constructivist agent indicated that when the constructivist agent was present participants tended to report a change in their perspective of instructional planning, reflected less on their thinking, and developed instructional plans rated as more constructivist in underlying pedagogy. Regarding attitude, a main effect for the presence of the instructivist agent indicated that when the instructivist agent was present, participants reported a more negative disposition regarding instructional planning. Results are discussed in terms of the impact on teaching instructional planning to pre-service teachers.

Introduction

In the field of instructional design, there are diverse theories and approaches to instruction (e.g., (Driscoll, 2000)). For pre-service teachers, the importance of seeing how these theories relate to real instructional problems is critical. Two prominent yet differing approaches to instructional planning are systematic instructional planning (referred to here as instructivism), based on an objectivist epistemology, and constructivism, based on an interpretivist epistemology (Jonassen, 1991). These two philosophical approaches lead to different understandings of human cognition and affect both the instruction that is developed and what evaluations are feasible and appropriate (Roblyer, 1996; Yarusso, 1992).

With its objectivist epistemic roots regarding knowledge, the underlying assumption of traditional instructional planning is that knowledge can and should be transmitted from teacher to student. An instructivist approach to instructional planning emphasizes knowledge transfer and teacher-centered learning environments, where skills are taught sequentially, incorporating individualized work with traditional assessment methods (Roblyer, Edwards, & Havriluk, 1997). This type of systematic approach to instruction has been shown to be effective due to its focus on clearly identifying goals and systematically developing instructional activities and assessment that lead to the attainment of the goals (Reiser & Dick, 1996).

In contrast, constructivism has its epistemic roots in interpretivism, which maintains that knowledge is personally constructed within individuals and does not exist external to the individual. The constructivist approach tends to focus on more student-centered environments, to provide activities that facilitate knowledge construction and generative learning (e.g., Wittrock, 1990). Driscoll (2000) describes five attributes of constructivist instruction: 1) embedding learning in complex and realistic environments; 2) providing for social negotiation; 3) supporting multiple perspectives and use of multiple modes of representation; 4) encouraging ownership in learning; and, 5) nurturing self-awareness of the knowledge construction process (pp. 382-383). To implement these features as part of the constructivist planning process, pre-service teachers must learn to emphasize the process of learning more than the end product. Constructivist approaches have been found to be particularly beneficial for developing meaningful learning activities and engaging students in higher order thinking (Jonassen, Peck, & Wilson, 1999)

One way to authentically demonstrate these two distinct approaches to pre-service teachers would be through seasoned professionals modeling the approaches in the context of a real instructional situation. Exposure and interaction with several experts describing instructional content matter from different points of view can be very rewarding for the learner (Laurel, Oren, & Don, 1990) and can help the learner to establish the best personalized approach to understanding the content. Further, such exposure to multiple pedagogical perspectives could enhance pre-service teachers' cognitive flexibility by requiring them to independently consider alternative points-of-view. Viewing an instructional problem from multiple perspectives is also desirable for promoting reflective thinking and problem solving, qualities important for pre-service teachers who are learning to be teaching professionals. Further, as Jonassen (1997) describes, "instructional planning is an archetypal ill-structured problem because "the designer is constrained by circumstances, though in most design problems, there are a variety of solutions, each one of which may work as well as any other (p. 69)." Given that more than one problem-solving path is possible to reach a solution, the ability for a pre-service teacher to take multiple perspectives on instructional planning is appropriate and necessary. Overall while it may be beneficial for our pre-service teachers to see their role in the classroom from multiple pedagogical perspectives (Bennett & Spalding, 1992), devising this sort of experiential exposure is difficult to implement with human instructors.

A promising possibility for demonstrating and experiencing different instructional approaches is through computer-based agents serving as a pedagogical mentors (Baylor, in press). A software agent is an independent computer program operating within software environments such as operating systems, databases, or computer networks (Roesler and Hawkins, 1994). Agents appear to have the characteristics of an animate being, and simulate a human relationship by doing something that another person could otherwise do for you (Seiker, 1994). Animated pedagogical agents have lifelike qualities, and can employ verbal instructional explanations together with nonverbal forms of communication (e.g., gaze, gesture, conveying emotion) in interacting with the learner. Along this line, Lester and colleagues (Johnson, Rickel, & Lester, 2000; Lester, Stone, & Stelling, 1999) have suggested that life-like agent characters are ideal to serve as tutors, coaches or guides in knowledge-based learning environments.

Further, learners treat computer-based agents as human, even when the computer interface is not explicitly anthropomorphic (Reeves & Nass, 1996).

Building upon Laurel's (1990; 1997) suggestion for agents to represent different "roles" such as characters in a play, the next question to consider is whether agents could represent different instructional roles as pedagogical mentors. While the idea of representing multiple instructional roles through computer-based media has been implemented in other research, there have been limited controlled studies. The ETOILE system for teaching educational psychology principles (Dillenbourg, Mendelsohn, & Schneider, 1994) incorporated five agents, each labeled after the teaching styles they implement: Skinner, Bloom, Vygotsky, Piaget, and Papert. Each agent was implemented as an independent rule base that was separated out from the content rather than being domain-specific. The five teaching agents implement decreasing level of directiveness: Skinner works step by stop, Bloom makes larger steps but with close control of mastery, Vygotsky is based on participation, Piaget intervenes only to point out problems and Papert does not interrupt the learner. The ETOILE system also includes a "coach" agent that is in charge of which tutor is used although the learner may also select or remove a tutor. The ETOILE system was not designed for the purpose of instructional research, but rather to conceptualize the underlying engineering principles for the multiple agents; consequently, there is no empirical evidence regarding its instructional impact.

MIMIC (Multiple Intelligent Mentors Instructing Collaboratively) is an agent-based learning environment developed for the purpose of instructional research (Baylor, 1999, 2000b). MIMIC situates instructional planning within a specific context: a case study of a thirteen-year old girl struggling with the economics concepts of supply and demand. In MIMIC, agents explicitly represent different perspectives of instructional planning (objectivism and constructivism) and facilitate pre-service teachers' internalization of these approaches. The animated three-dimensional pedagogical agents serve as scaffolds, providing cognitive support to pre-service teachers while they write an instructional plan. The learner has control over the amount of assistance and when it will be provided by the agent(s). In related research, participants working with both the instructivist and constructivist pedagogical agents could differentiate between them and could explicate the two theories that they represented (Baylor, in press). The agents were also reported to be believable and useful. (Baylor, in press).

Hietala & Niemirepo (1998) suggest that the same social factors that occur in learning communities with human beings are also influential in a learning community consisting of multiple artificial teaching and learning agents. They refer to this aspect as the need for pedagogical multiplicity of teachers, suggesting that the many levels and complexities of the learning process might be alleviated by providing more alternatives to the learner via an "extended family of intelligent agents." Essentially, an agent-based learning environment such as MIMIC allows pre-service teachers to figuratively "put on different hats" and facilitates them in switching roles when needed to solve an instructional problem. Through experiential interaction with the agents, the pre-service teacher is facilitated in a deep approach to the task, focusing on the meaning of the instructional planning process itself, rather than a surface approach which would involve simply writing an instructional plan following a "recipe." In this way, the pre-service teachers' experience of instructional planning and the specific meaning it has for them could be considered as the most fundamental aspect of learning (Marton & Booth, 1997).

In this exploratory experimental study, it is hypothesized that the presence of the instructivist and constructivist agent(s) (especially both simultaneously) will impact learners' awareness of instructional planning by increasing their reflection during the instructional planning process and changing their perspective regarding instructional planning. It is not hypothesized that the presence of agents will affect performance given that it is generally found that the presence of agents does not significantly improve performance (Dehn & van Mulken, 2000); however, it is predicted that pre-service teachers' transformation of awareness will be reflected by the instructivist or constructivist "flavor" of their instructional plans, depending on which agent(s) are present. In terms of attitudes, it is predicted that the presence of the agents as scaffolds would positively influence participants' dispositions, self-efficacy and perceived instrumentality regarding instructional planning.

Methods

Sample

The sample consisted of 135 pre-service teachers, in eight sections of an "Introduction to Educational Technology" course. As part of this required course, the participants had already been taught an instructivist model of instructional planning (Reiser & Dick, 1996) and a constructivist approach to instructional planning (Grabe & Grabe, 2001) with identical course material (e.g., lectures, Powerpoint slides, assignments, exams) across the eight sections. Participation in this study was a required activity for class participants, and they received course credit for participating. The mean age of the sample was 19.76 years (*SD*=2.13). Of those reporting ethnicity, 84% were Caucasian, 4% were Hispanic, 10% were African American, and 2% were of other groups. Of those reporting gender, 21.5% of the sample were male and 78.5% were female. Sixty percent (the majority) of the participants were sophomores, 27% were juniors with 7% freshman and 6% seniors. In terms of prior experience with instructional planning, participants' mean score was 2.23, (*SD*=.97), where 1=no experience and 5=very much experience, indicating that overall they had little prior experience. There were no significant differences in age and GPA among the participants in all conditions. In terms of ethnicity, gender, and year in school, chi-square analyses revealed no significant differences between the groups.

Multiple Intelligent Mentors Instructing Collaboratively (MIMIC) Environment

From the learner's perspective, MIMIC consists of an introduction, a case study, blueprints stage, plan stage, and assessment stage. The introduction begins with the statement that "We are pleased that you have decided to join our educational consulting firm, 'Instruction Inc.' Given your new skills in instructional planning, we have a project for which we really need your help," and briefly describes the case study situation with thirteen-year-old Anna and her teacher Mr. Lange. Following this, the participant is instructed how to move throughout the environment:

Through our computer-based system, you will be able to follow 3 steps in devising your instructional solution. The three components of the project include the following:

1. STEP 1: Blueprints for Instruction: This is where you will first determine the goals of the instruction; in other words WHAT you want the learner to be able to do at the end of the process.
2. STEP 2: Developing the Instructional Plan: Here you will get into the "heart" of the planning process, and develop a detailed plan that a teacher can use to carry out the instruction as you specify.
3. STEP 3: Assessment: At this stage you will determine how to measure whether the learner actually learned what you intended.

At any time you may refer back to the details of the case study to refresh your memory of the situation.
You may go back and forth as much as you would like among the 3 components. And when you are completely finished with your plan, press the Finished button you'll find in the assessment stage.

Next, if participant is in a 1- or 2-agent condition, the personal Advisor(s) (see "Pedagogical Agents" section) would introduce themselves and their role.

The environment organized the participant's instructional planning processes into four main phases which will be described below, each indicated through large icon-buttons: case study, blueprints, planning, and assessment. At any time it is possible for the participant to move from one phase to the other although it is not possible for the participant to return to the introductory screens. Once the participant enters the assessment stage, an additional button labeled "Finished" is provided. After selecting "Finished" the participant is asked "Are you ready to exit the application and go to the exit survey?" Upon selecting "OK" the participant answers post-questions.

Case study. The case study was developed for MIMIC given that it is difficult to find existing case studies that are appropriate (Ertmer & Russell, 1995). It consisted of a description of Anna and her problems learning supply and demand, her teacher Mr. Lange, and her school in Texas. The concept of supply and demand was chosen as it is relatively domain-independent of specialty areas for instruction and requires less specific prior knowledge. Links were provided so that the participant could access Anna's homework that contained comments from Mr. Lange, and his personal planning notes which included text and graphics. In this way, participants could review the necessary content for themselves as well as evaluate Anna's situation.

Blueprints. The purpose of this phase was listed on-screen as follows: "The purpose of this step is for you to decide what you want Anna to learn. What have you determined to be the learning goals? List them clearly in the workspace below. For reference you may want to see the stated Texas standards and benchmarks regarding supply/demand for eighth graders, with links below." A text-box field was provided within which the participant could list the instructional goals or objectives. Two links provided additional information regarding Texas standards and benchmarks for supply/demand.

Planning. The purpose of this phase was listed on-screen as "To develop a detailed instructional plan for Anna. " A text-box field was provided within which the participant could enter the instructional plan.

Assessment. The purpose of this phase was listed on-screen as follows: "The purpose of this phase is to develop ways to determine if Anna learned what you initially defined in the blueprints phase. Please describe this assessment in detail in the space below. " A text-box field was provided within which the participant could list the assessment.

Pedagogical Agents

Depending on the experimental condition, one or two Microsoft Agent characters (Peedy the Parrot and Merlin the Wizard) were implemented as "Advisors" to the participants. Characters were randomly assigned to represent the instructivist and constructivist agents and to control for possible differences. The Advisors were referred to by gender-neutral names – Jan and Chris. Jan was always the instructivist advisor, representing traditional systematic instructional planning including the problem-solving aspects of Instructional Systems Design (ISD) as characterized by Dick & Carey (1996) and Reiser & Dick (1996). Chris was always the constructivist advisor, representing a learner-centered approach, focusing on the importance of the context of learning, stressing that learning involves active interaction, and emphasizing the process rather than the product of learning (Driscoll, 2000).

The purpose of the agents was to serve as mentors (Baylor, 2000a) and to operationalize the instructivist and constructivist approaches to instructional planning. When one or two agents were present the following events resulted: 1) the agent(s) provide(s) an initial observation upon entering each of the four MIMIC planning stages; 2) the agent(s) provide(s) reflection questions to encourage self-evaluation consisting of statements "Make sure you are not just talking about how you would do it; actually create the instruction for Mr. Lange (Anna's teacher).", "Actually develop the content-related activities", or "Apply the plan specifically to the topic of supply and demand" every five minutes upon entering a stage; 3) the agent(s) would provide an example of their instructional plans following the participant's development of an instructional plan; and, 4) the agent(s) would provide additional suggestions when selected by the participant. Agent suggestions were specific to the case study and were developed and validated by experts in instructional planning together with the consultation of an economics professor. The available suggestions (specific to each planning phase) would appear in a pop-up box for the participant to select. For example, in the plan phase, one available suggestion is “What is my role in the learning process?” If this suggestion were selected from the instructivist agent, the agent would reply “You need to be in charge of the learning process for Anna. You need to organize the materials for Anna, to create an optimal learning environment.” The same suggestion if requested from the constructivist agent would be “Anna should be at the center of the learning process. This will encourage Anna’s initiative, get Anna to think and to reflect, and make the information real for Anna.” The blueprints phase had two suggestions, the plan phase had five suggestions, and the assessment phase had one suggestion. See a related study (Baylor, in press) for a complete listing and description of all agent suggestions.

Measures

Awareness. Awareness was assessed through three dependent measures: whether the participant changed perspective in instructional design, amount of participant’s reflective thinking, and the underlying pedagogy of the participant-designed instructional plan. To assess whether use of the system *changed participants’ perspective of instructional design*, they were first asked “Did using this program change your perspective of instructional design? (yes/no)" which was coded as a 1 (yes) or 0 (no). To assess participants’ *self-reported reflections,* they were asked, “How often did you reflect on your thinking during the process?” on a Likert scale of 1-3 with “Not at all,” “Several times,” and “Frequently” as the three levels. To assess the *underlying pedagogy of the instructional plans,* the instructional plans were scored according to their overall pedagogical “flavor,” on a scale from 1 to 10. Given that certain instructional plan features are representative of both instructivist and constructivist pedagogies (e.g., the importance of considering prior knowledge), the focus was on assessing the presence (or absence) of constructivist characteristics, as they were more salient and differentiable. A high score in this measure indicates that there were more constructivist aspects to the plan such as a student-centered approach, students’ involvement with constructing knowledge, a focus on students' reasoning/critical thinking, and/or situated learning. A low score in this measure indicates that there are less constructivist and more characteristically instructivist elements within the plan. Two of the researchers met and together discussed what characterized a score of 1-10 for the presence of underlying pedagogy (where 1=not at all constructivist and 10=highly constructivist) for five sample instructional plans. Following that, each researcher independently scored 15 instructional plans. Inter-rater reliability between the two researchers was determined to be greater than .9 for the fifteen instructional plans. One of the researchers then scored the remainder of the instructional plans using the same rubric. Both researchers were blind as to the conditions of the participants throughout the rating process.

Attitudes. Attitudes were assessed by three dependent measures, each as repeated-measures: self-efficacy, disposition, and perceived instrumentality. To assess participants’ *self-efficacy*, one item to measure the students' self-efficacy beliefs about instructional planning was administered before entering and after exiting the MIMIC environment. It was developed based on Bandura and Schunk's (1981) guidelines. All participants were asked "How sure are you that you can write a lesson plan?" on a scale from 1 being not-sure to 9 being very sure. The test-retest reliability was r=.62 (p<.001). To assess participants’ *disposition* toward instructional planning, each participant was asked to write two adjectives to "Describe what you think about instructional planning." This method was employed to obtain the participants' personal affect regarding instructional planning as opposed to the response set that could bias them to choose more favorable adjectives if adjectives were presented in a list. The adjectives were coded according to three levels: as -1 if both were negative, as 0 if one was negative and the other positive, and as +1 if both were positive. The items were coded by two raters independently. Interrater reliability was established at .95. There were only two disagreements about two sets of adjectives which were resolved through discussion. Two adjective pairs were discarded because they could not be classified. The validity of this measure was established in (Kitsantas & Baylor, 2001) through concurrent validity of initial disposition with initial self-efficacy scores, given that research has shown that self-efficacious students generally have positive affect (Bandura, 1986). The test-retest reliability was r=.55, p<.001. To assess the participants' *perceived instrumentality*, or perceived importance of instructional planning, the participants were asked to rate "How important is writing a lesson plan to you as a future professional?" on a scale of 1 to 5 where 1= not important, 2=fairly important, 3=important, 4=very important, and 5=extremely important. Test-retest reliability was r=.83, p<.001.

Performance. Within MIMIC, all participants developed an instructional plan to teach the concepts of supply and demand to Anna. Each instructional plan was scored according to a rubric that consisted of four sub-areas. The four sub-areas of the rubric were goals/objectives, procedure, assessment, and holistic, the first three being aligned with the major components of instructional planning (goals/objectives, procedure, and assessment). For the goals/objectives sub-score, the plans were rated according to how clearly the goals/objectives were stated and how specifically the purpose of instruction was described. For the procedure sub-score, the plans were rated according to the meaningfulness and effectiveness of the instructional activities, whether they were in a logical sequence, and whether they addressed the goals stated in the blueprints phase. For the assessment sub-score, the plans were rated according to whether the assessment matched the goals/objectives, and whether it was logical. For the holistic sub-score, the plans were rated according to whether the plan was overall reasonable and effective. The overall performance score was the compilation of these four sub-scores (each rated from 1 to 5), with a potential range of 4-20. Two of the researchers met and together discussed what characterized a score of 1 through 5 (where 1=poor and 5=excellent) for each of the four sub-areas for five sample instructional plans. Following that, each researcher independently scored 15 instructional plans. Inter-rater reliability between the two researchers was determined to be greater than .9 for the fifteen instructional plans. One of the researchers then scored the remainder of the instructional plans using the same rubric. Both researchers were blind as to the conditions of the participants throughout the rating process.

Agent value. Participants in conditions where agents were present were asked to rate the value of the agents in several areas. Specifically, they were asked via Likert-scale formatted questions, “Did you enjoy working with <agent>?” (Not at all / A little / Very much/ Extremely); “Did you pay attention when <agent> made suggestions?” (Not at all / Not usually / Usually / Always); “Overall, was <agent> annoying or useful?” (Extremely annoying / annoying / useful / very useful); and, “Did you generally agree with <agent>’s suggestions? (yes/no)”

Procedure

All participants logged in to the MIMIC computer environment and answered computer-based questions regarding gender, age, and class section number. Next, the participants' perceived instrumentality, disposition regarding instructional planning, prior experience with instructional planning, and self-efficacy beliefs toward instructional planning were assessed. Following these initial measures, the participant entered the introduction to the MIMIC environment (see the MIMIC section). Following this introduction, and immediately before entering the environment, participants’ self-efficacy regarding the project was ascertained. Next, the participants worked through the case study, blueprints stage, planning stage, and assessment stage, developing an instructional plan. Depending on the condition (see “Pedagogical Agents” section), 0-2 agents were present within the environment, serving to represent instructional planning approaches (objectivism and/or constructivism). All participants worked independently within the environment at their own pace. Following completion of the instructional plan within the environment, all participants answered computer-based questions regarding amount of self-reflection, value of agent(s), perspective of instructional planning, perceived instrumentality, disposition, and self-efficacy. The entire procedure took approximately 90 minutes.

Design and Data Analysis

A three-factor MANOVA (instructivist agent: present, absent; constructivist agent: present, absent; agent character: Peedy, Merlin) was the initial method used for data analysis where agent character (Peedy the Parrot or Merlin the Wizard) was assigned as a within-subjects factor to test for possible differences in agent character. After it was determined that agent character did not play a factor, that factor was removed from further analysis leaving a two-factor MANOVA as the main method for data analysis. The data was analyzed according to two groups of dependent measures: awareness (comprised of change in perspective, reflection, and underlying pedagogy of instructional plan), and attitude (comprised of self-efficacy, disposition, and perceived instrumentality), each of which was assessed via a two-factor MANOVA. The analysis of attitude (comprised of self-efficacy, disposition, and perceived instrumentality) was treated as a repeated measures MANOVA. For some analyses that focused on agent combinations, a one-way MANOVA/ANOVA was also performed with condition (no agents, instructivist only, constructivist only, both agents) as the factor. To analyze participants’ value of the agents, independent-group t-tests were used for the questions comparing one agent on a particular attribute, and paired-group t-tests or chi-square analysis were used for the questions regarding participants who received both agents.

Results

General

There were no statistically significant differences among agent conditions regarding the average number of suggestions requested from the agents. The average number of suggestions selected was M=10.34.

Awareness

The three dependent measures for awareness include whether the participant changed in perspective regarding instructional planning, amount of self-reflection, and underlying pedagogy of participant-designed instructional plan and were assessed through a two-way MANOVA with instructivist (present, absent) and constructivist (present, absent) as the between-subject factors.

Perspective of instructional planning. Results from the two-way MANOVA revealed a main effect for the constructivist agent on change in perspective in instructional planning, $F(1, 131) = 9.82$, $p<.01$, where M=.71 (present) versus M=.45 (absent), indicating that when the constructivist agent was present, participants were more likely to report that MIMIC changed their perspective of instructional planning. There were no other significant main effects or interactions. To determine the relative differences of change in perspective among the four agent conditions, a one-way ANOVA with condition (no agents, instructivist only, constructivist only, both agents) as the factor was conducted and revealed a significant main effect for agent condition, $F(3, 131)=3.74$, $p=.01$. Post-hoc Tukey’s tests indicated that the constructivist-only condition elicited the most change in perspective (M=.80) and was significantly greater than both the instructivist-only condition (M=.47) and the no-agent conditions (M=.44) , but was not significantly greater than the both-agents condition, which ranked second in overall change in perspective (M=.63).

Self-reported reflection. The two-factor MANOVA revealed a main effect for the constructivist agent, indicating that when the constructivist agent was present, participants reported reflecting less (M=2.24), than when it was absent (M=2.43), $F(1, 131)=4.73$, $p<.05$. There were no significant differences between high and low performers on self-reported reflection.

Underlying pedagogy of instructional plan. The two-factor MANOVA indicated a main effect for the constructivist agent, $F(1,131) =11.28$, $p=.001$, where the presence of the constructivist agent was related to participants developing more constructivist-oriented instructional plans (M=6.12) than when it was absent (M=4.47). While there was not a statistically significant main effect for the instructivist agent, there were numerical differences showing that its presence was associated with lower scores (M=4.92) than its absence (M=5.72), indicating its positive relation to an instructivist underlying pedagogy. An independent t-test also showed that high achievers developed plans that were significantly more constructivist (M=6.08) in approach than low achievers (M=4.29). The overall mean for the underlying level of pedagogy for all participants was M=5.35, SD=3.01.

Attitude Attitude was analyzed through a repeated-measures two-factor MANOVA, with disposition, self-efficacy, and perceived instrumentality as the dependent measures, each assessed both before and after working in MIMIC, and with the instructivist agent and the constructivist agent as the two between-subject factors.

Disposition regarding instructional planning. The two-factor repeated-measures MANOVA indicated a main effect for the presence of instructivist agent $F(1, 128)=3.46$, $p<.05$, revealing that when the instructivist agent was present, participants had significantly lower dispositions regarding instructional planning (M=.54) than when the instructivist agent was absent (M=.75). Overall, participants' disposition toward instructional planning was generally positive (where –1 represents negative, 0 represents neutral, and 1 represents positive), both before (M=.63) and after (M=.58) working within MIMIC.

Self-efficacy. The two-factor repeated-measures MANOVA revealed a main effect for time of assessment, showing that participants overall increased in self-efficacy (M=5.46 vs. M=6.01) as a result of MIMIC, $F(1,128)=12.54$, $p=.001$. There were no significant main effects or interactions for the presence or absence of the constructivist and instructivist agents. As would be expected, self-efficacy was highly related to participants' prior experience with instructional planning. Those participants with high experience writing lesson plans (3, 4, 5) as compared to those with low experience (1, 2; where 1=no experience and 5=very much experience), had significantly higher self-efficacy both before (M=6.40 vs. M=4.91), $t(133) = 4.06$, $p<.001$, and after (M=6.62 vs M=5.63), $t(133) =3.11$, $p=.001$, using MIMIC.

Perceived instrumentality. The two-factor repeated-measures MANOVA did not show any significant main effects or interactions. Participants' perceived instrumentality was M=4.11 for the pre-test, and M=4.18 for the post-test, indicating that they believed instructional planning to be slightly more important than "very important" both before and after the use of MIMIC.

Performance Performance was analyzed through a two-factor MANOVA, with each of the four sub-scores and the total score as the dependent measures, with instructivist (present, absent) and constructivist (present, absent) as the two between-subject factors. Results revealed no main effects or significant interactions for the total performance score or each of the four sub-scores. The total performance score ranged from 4-20, with the overall average of M=13.71, SD=4.10. Descriptive statistics for the sub-scores were as follows: goals/objectives --M=3.38, SD=1.32; procedure-- M= 3.30, SD 1.10; assessment -- M=3.26, SD=1.29; and, holistic -- M=3.23, SD=1.14. Based on the total performance score, participants were categorized as high performers if they scored in the top quartile (total score of M=16 and above), and low performers if they scored in the bottom quartile (total score of M=10 and below).

Agent value Agent value was assessed in several areas, as listed below.

Enjoyment in working with agent. Participants tended to enjoy working with both agents (M= 2.63 for instructivist agent and M=2.64 for constructivist agent), where 2="A little" and 3="Very much." A non-significant t-test of the two groups (those with constructivist present versus those with instructivist present) revealed that participants reported finding both agents to be equally enjoyable. *Attending to agent*. Participants tended to pay attention to both agents (M= 3.05 for instructivist agent and M=3.21 for constructivist agent) where 3= "usually" and 4="always". A non-significant t-test of the two groups revealed that participants reported paying relatively equal attention to both agents. *Usefulness of agent.* Participants tended to report that both agents were useful (M=3.02 for instructivist agent and M=3.08 for constructivist agent) where 3="useful" and 4="very useful". A non-significant t-test of the two groups revealed that participants reported finding both agents equally useful. *Agreement with agent.* In terms of whether participants agreed with the agents' advisements, answers were coded as yes=1 and no=0, and results show that participants tended to agree with both of the agents' suggestions, M=.67 for instructivist and M=.84 for constructivist. A non-significant t-test of the two groups revealed that participants reported not agreeing significantly more or less with either agent.

Discussion

Overall, the results indicate that the presence of the constructivist pedagogical agent affected pre-service teachers' metacognitive awareness of instructional planning in multiple ways: through a change in perspective, less reported reflection, and through the underlying pedagogy of their instructional plans.

It is speculated that increased awareness about instructional planning would lead to a richer and more comprehensive understanding of the planning process, leading pre-service teachers to develop an appreciation for the process. As stated by Marton and Booth (1997),"of prime interest is the variation in the ways in which people are capable of experiencing various situations or phenomena. If one becomes aware that something is in a certain way, they also become aware that it could be in some other way" (p.207). Eventually, it would be expected that this change in perspective and understanding of the depth and complexity of instructional planning could lead to better performance and/or increased intrinsic motivation related to the task.

The presence of the constructivist agent tended to change participants' perspective toward instructional planning. Although participants had been introduced to the constructivist approach as part of the course in which they were enrolled, it still may have been experienced as a novel and unique approach. Given that some pre-service teachers describe instructional planning negatively, using adjectives such as "boring," or "tedious" (Kitsantas & Baylor, 2001), the constructivist approach may have been perceived as offering something new and providing more options for instructional planning. Further, the presence of the constructivist pedagogical agent could have been perceived to highlight more appealing elements of instructional planning (such as a student-centered focus or responsibility of the learner).

While the two-agent condition (given that it had the constructivist agent present) was more transforming than the instructivist only or no agent conditions, it was not found to lead to a significantly greater change in perspective than the other three agent conditions, as was predicted. The fact that the presence of two agents simultaneously was not perceived as the most transforming in terms of a change in perspective could be an issue of cognitive load. As Sweller and colleagues suggest (Sweller, van Merrienboer, & Paas, 1998) "less is best" in learning situations, indicating that in this case the learners may be too focused during problem solving to process suggestions from multiple agents.

The finding that the presence of the constructivist agent led to less reflection seems at first incompatible with the finding that the constructivist agent led to a greater change in perspective. However, when the constructivist agent was present, perhaps participants were focusing their attention on its ideas/suggestions rather than reflecting on their own cognitive processes. In other words, it seems viable that the presence of constructivist agent facilitated pre-service teachers to think more (i.e., change perspective), but not necessarily to reflect more. While there is strong evidence that reflection during instructional activities is important (Chi & VanLehn, 1991; VanLehn, Jones, & Chi, 1992), there is less information regarding the relative value of reflection as compared to awareness. Future research should include an open-ended follow-up question to determine what pre-service teachers actually meant by reporting less reflection.

The presence of the constructivist agent was also associated with participants' developing more constructivist-oriented instructional plans, reflecting a "trickle down" effect of the agent's pedagogical beliefs to the participants. Although there was not a main effect where the presence of the instructivist agent was related to lower underlying pedagogy score (thus indicating a more instructivist-oriented underlying pedagogy in the instructional plans), there were numerical differences showing that the presence of the instructivist was associated with lower scores in this area, indicating that in both cases (presence of instructivist and presence of constructivist) the pre-service teachers internalized the agent's suggestions and translated them in their instructional plans.

Overall, the agents were perceived by the pre-service teachers to be valuable as mentors. Participants reported neither agent to be "better" or "worse" in any of the following aspects: enjoyment of working with agent; paying attention to agent; perceived usefulness of agent; and, credibility of agent. Further, the pre-service teachers who received both agents were equally split as to which agent made them think the most, which thought the most like them, and which of the two agents they would choose to assist them (if could choose only one). Agents were rated as equally useful, they also were paid equal attention, and were equally enjoyable with which to work.

While there were no explicit differences between the agents in terms of value, there were differences in the effect of the agents on attitude. Contrary to what was hypothesized, it was found that the presence of the instructivist agent led participants to report significantly lower dispositions regarding instructional planning. Given that the instructivist agent represents a systematic approach, perhaps students felt it was too prescriptive, and made the instruction and/or planning process seem tedious or boring. While there were no main effects on self-efficacy for the presence of the agents, self-efficacy increased for participants using the MIMIC system, suggesting a practice effect. A reason that may explain why there were no effects of the agents on perceived importance of instructional planning could be that participants started with already-high ratings (rating it on average as slightly more important than "very important").

There were no main effects of the agents' presence for the overall performance score which was expected given that related research has not provided evidence that animated agents improve learning (Dehn & van Mulken, 2000). Further, the MIMIC agents provided suggestions regarding the underlying pedagogic rationale for different aspects of the planning process, not solutions. While these advisements were content-specific, they did not specifically prescribe or show the students exact implementation.

In terms of the overall implications, there is preliminary evidence to suggest that the exposure to constructivism as an instructional planning process adds richness, diversity, meaning and interest. While the instructivist approach adds substance and structure to the process, it may negatively affect disposition. If only one perspective could be provided to enrich their awareness of instructional planning, exposure to the constructivist approaches may be most beneficial, especially if the pre-service teachers already have a strong foundation in instructivist approaches to instructional planning.

Future research could implement the study with more advanced pre-service teachers or instructional designers, to determine how the agents impact them in terms of awareness of and attitude towards instructional planning. Another way to explore a change in awareness could be through including epistemology profiles to determine if pre-service teachers epistemic beliefs change as a result of using the system. The role of reflection needs to be further investigated through more open-ended questions and to systematically evaluate the agents for their self-regulatory features to determine what promotes monitoring and evaluation and how they relate to what the participant terms "reflection." Cognitive load as an explanation for the impact of two agents needs to be further examined with more advanced students, who may be able to better manage receiving advisements from multiple agents.

Overall, this study validated the effectiveness of an agent-based approach as a research process to investigate teaching and learning by simulating human-like mentoring via pedagogical agents (Baylor, in press). The instructivist and constructivist agents within MIMIC provided an indirect and meaningful way to investigate students' affect and beliefs toward instructional planning.

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Introducing the IPSRT (Instructional Planning Self-Reflective Tool) and CPSRT (Constructivist Planning Self-Reflective Tool): Self-Regulatory Tools to Promote Instructivist and Constructivist Instructional Planning for Preservice Teachers

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Abstract

The Instructional Planning Self-Reflective Tool (IPSRT) and the Constructivist Planning Self-Reflective Tool (CPSRT) were developed to facilitate self-regulation during instructional planning for pre-service teachers. We developed the IPSRT tool to promote the adaptation of traditional instructional planning methods and the CPSRT tool to promote the use of effective constructivist planning principles for pre-service teachers. This paper will present the two tools and provide suggestions based on empirical research for instructors of teacher preparation programs on how to assist pre-service and in-service teachers to become self-regulated instructional planners.

Introduction

Instructional planning is a key element of the teaching process. Teacher preparation programs spent a significant number of hours instructing pre-service teachers how to write effective instructional plans. Two major theoretical perspectives, the instructivist and the constructivist approaches to instructional planning, are implemented by colleges of education to prepare future teachers. However, writing an instructional plan for a specific student population requires more than knowing the essential elements that constitute an effective instructional plan. It requires the teacher to use self-regulatory processes, especially self-monitoring and self-evaluation that will enable him/her through reflection to tailor the instructional plan to the needs of the particular group of students.

Description of the Two Tools

IPSRT (Instructional Planning Self-Reflective Tool)

We developed the Instructional Planning Self-Reflective Tool (IPSRT) based on both research on self-regulated learning (e.g., Zimmerman, 2000) and the Reiser & Dick (1996) instructional planning model. It was designed to facilitate teachers' self-monitoring and self-evaluation during instructional planning. See Baylor, Kitsantas & Chung (2001) for the complete tool.

The major headings for the IPSRT were determined according to the Reiser & Dick (1996) instructional model: instructional goal, objectives, materials/preparation, learner characteristics, procedure, and assessment. Under the heading for objectives, there are specific subheadings for the four basic components of an instructional objective: audience, behavior, condition and degree. Under the heading for procedure, listed are the six subheadings of instructional elements: motivating students, informing students of objectives, helping students recall prerequisites and presenting information and examples, providing practice and feedback and summarizing the lesson. These are considered the necessary steps for developing instructional activities. An additional section was added for users to self-evaluate the quality of the overall instructional plan. Under each subheading, the IPSRT consists of questions with prompts to remind the users of what should be included in a traditional instructional plan.

We initially tested the IPSRT with 175 pre-service teachers, who were enrolled in seven sections of an "Introduction to Educational Technology" course and used the IPSRT tool to construct several instructional plans. These pre-service teachers were asked what was helpful about using the tool for instructional planning. Eighty-percent of participants reported that the IPSRT was useful for self-monitoring, 75% stated it was useful for self-evaluation, and 25% mentioned that it was beneficial for organization (Baylor, Kitsantas & Chung, 2001). Given that the IPSRT was developed specifically for self-monitoring and evaluation, the results supported its value as a cognitive tool in these two areas.

The Constructivist Planning Self-Reflective Tool (CPSRT)

We designed the Constructivist Planning Self-Reflective Tool (CPSRT) on the basis of research on self-regulated learning (Zimmerman, 2000) in association with the constructivist approach to instructional planning (Jonnasen, 1999). It was developed as a "Learning Support Plan" to support pre-service teachers in defining the key characteristics of an effective constructivist learning environment. See Kitsantas, Baylor & Hu (in press) for the complete tool.

It is organized according to three phases. The first phase "Before" (for activities prior to the implementation of instruction), includes the instructional purpose, and defines learning activities with both required and desirable characteristics. The required characteristics of learning activities refer to constructivist features such as the importance of cognitive activity and the focus on the learning process as opposed to acquiring specific knowledge. The desirable characteristics contain the attributes such as ill-structured tasks, definition by learner and the social environment for the activities. The second phase “During” (for activities during the implementation of instruction), describes the role of the student and the instructor, e.g., students should be active in the learning process, students should take the major responsibility for their learning, and teachers act as facilitators of the learning process. The third phase “After” (for activities following the instruction), comprises the assessment of students’ learning, which also emphasizes the activity-based nature of the constructivist approach by examining if the assessment measures the instructional goals and involves some sort of performance by the learner. This tool does not specify what needs to be included in the instructional plan, but rather provides suggestions for consideration within the constructivist framework.

We tested the CPSRT tool with approximately 150 pre-service teachers, who were registered in eight sections of an “Introduction to Educational Technology” course. The results of the evaluation show that this tool is constructive for self-evaluation, organization, monitoring, and cognitive flexibility. Thirty eight percent of participants reported that the CPSRT was useful for monitoring, 38% stated it was convenient for self-evaluation, and 33% mentioned that it was effective for organization, and 31% commented that it is beneficial for cognitive flexibility (Kitsantas, Baylor & Hu, in press). As compared to the IPSRT, the CPSRT is valuable for promoting cognitive flexibility (Baylor & Kitsantas, 2001), which is a critical component for the constructivist planning approach.

Recommendations for use

Based on empirical research, the following recommendations are presented for instructors using the two tools for instructivist and/or constructivist approaches to instructional planning.

IPSRT is useful for pre-service teachers who have limited experience in teaching because it provides them with systematic procedures to follow.

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Pre-service teachers may not be very familiar with the instructional elements that are necessary for an effective instructional plan. The IPSRT is good for traditional instructional planning because it is well structured, and the organization provided by the IPSRT tool is consistent with the step-by-step nature of traditional classroom instruction. The IPSRT can serve as a checklist for inexperienced pre-service teachers to make sure that they have included all the necessary instructional elements of a instructional plan.

The IPSRT includes a number of questions with check boxes for the pre-service teacher to review whether each area is covered in his/her current instructional plan. For example, when writing an instructional plan, pre-service teachers do not always include the four major components of instructional objectives. The questions in the objective part of the IPSRT tool not only remind the users of these critical sections of an instructional objective but also give pre-service teachers a recap on the important characteristics of these elements. See the following excerpt:

OBJECTIVE(s):

- Are all four of the following components present for each objective?
  ❑ yes ❑no
  1. Audience
  - Does this component state who will be doing the performance? ❑ yes ❑no
  2. Behavior
  - Is the behavior measurable and observable? ❑ yes ❑no
  3. Condition
  - Is the context for the behavior specified? ❑ yes ❑no
  4. Degree
  - Does this component clarify how well/to what extent the performance must be done?
    ❑ yes ❑no

The IPSRT tool is especially helpful when pre-service teachers are concerned or having difficulty with writing instructional plans. Instructors of pre-service teachers can provide the IPSRT tool as a job aid for their in-class or take-home instructional planning practice. With the tool in their hands, the instructor can review the instructional elements with the pre-service teachers and then explain how they can use the tool to monitor and reflect on their own instructional plan composition. Once they understand how to use the tool, they should be able to focus on the content of the instructional plan instead of unnecessarily worrying about missing any instructional elements in the structure. Further, it has been shown that the use of the IPSRT is best introduced and used <u>prior</u> to introduction of the CPSRT to serve as a strong foundation in systematic methods of instruction (Baylor & Kitsantas, 2001).

The IPSRT enhances pre-service teachers’ intrinsic motivation for instructional planning

Pre-service teachers often have limited knowledge and skills writing instructional plans, and are much less confident than experienced teachers. We found in an experimental study with the IPSRT (Kitsantas & Baylor, in press) that pre-service teachers tend to have negative attitudes initially about instructional planning. During the experiment with 175 pre-service teachers, partially designed to assess the pre-service teachers’ dispositions towards instructional planning, participants were asked to list two adjectives to describe their thoughts regarding instructional planning. We found that participants who did not use the IPSRT were slightly negative towards instructional planning whereas participants who used the IPSRT were positive. Some of the positive adjectives used by the participants were "organized," "helpful," "important," while some of the negative adjectives were "time-consuming," "tedious," "boring," This finding is a powerful empirical evidence of the positive effect of using the IPSRT tool to improve pre-service teachers' disposition towards instructional planning.

Pre-service teachers' self-efficacy, defined as the degree to which they feel competent in writing an instructional plan, is also affected by the use of the IPSRT. Pre-service teachers that initially reported high self-efficacy beliefs to write an instructional plan, following use of the IPSRT, realized that instructional planning is a far more complex activity than they originally thought. On the other hand, pre-service teachers initially reporting low self-efficacy beliefs to write an instructional plan, felt more confident after using the IPSRT (Kitsantas & Baylor, in press). These findings suggest that this tool serves as a reflective mechanism for high self-efficacious learners who believe that they have the skills to write effective instructional plans, and enhances the motivation of those who believe that they lack the skills to succeed in this task.

With the IPSRT tool serving as a job aid or cognitive tool, pre-service teachers may expend more mental effort to writing the content of the instructional plan, allowing for the development of more effective and creative instructional plans. Furthermore, the improvement in their performance in instructional planning as well as the self-evaluation conducted by pre-service teachers using the IPSRT will positively reinforce the pre-service teachers, and may make them feel more confident and motivated in carrying out this task in the future.

The IPSRT promotes a greater metacognitive awareness of the complexity of instructional planning

The IPSRT is also beneficial to pre-service teachers because it functions as a guide for users to monitor and evaluate their performance, thereby improving metacognitive awareness. The prompt questions in each subheading help the pre-service teachers examine the adequacy, clarity and accuracy of their instructional plan content.

From a micro-perspective, pre-service teachers may have difficulties applying the necessary skills within each instructional planning phase (e.g., writing objectives, formulating test items). From a macro-perspective, pre-service teachers do not always understand how the phases are interrelated and interconnected in the process of instructional development. Frequently pre-service teachers see the process as incremental (e.g., the individual phases or tasks) and fail to see the global aspect of the overall planning model. For example, when evaluating their objectives with the IPSRT, it guides them on the micro level in writing learning objectives using the four components such as audience, behavior, condition and degree, while at the same time relating this particular micro-level part to the macro-level structure of instructional goal section by asking "Does each objective derive directly and logically from one of the instructional goals?" Pre-service teachers improve their critical thinking skills by alternating between the two levels. Therefore, the IPSRT is designed to facilitate the use of self-regulation strategies from both the macro and micro perspective, listing specific strategies within each component of the instructional plan and strategies referred to the overall connectivity and holistic value of the instructional plan respectively.

The CPSRT provides exposure to constructivist methods of instruction for pre-service teachers.

Constructivism represents a very different approach to instructional planning. Most of the pre-service teachers are novice to the constructivist principles about instruction. The structure of the CPSRT tool and the prompt questions in each phase are representative of typical constructivist instruction characteristics. The CPSRT can thus figuratively serve as a "menu of ideas" for inexperienced pre-service teachers to select appropriate instructional elements of a constructivist instructional plan. Not only does the CPSRT provide exposure to constructivist methods, but also it was found to facilitate self-efficacy in the process (Baylor & Kitsantas, 2001).

The following excerpt illustrates that in a constructivist approach learners need to be cognitively active and take responsibility for the learning process whereas the instructor should try to facilitate the learning process instead of directly imparting knowledge.

<u>Role of Student</u>

- Are the students
  - o Engaged and cognitively active? ☐ Yes ☐ No
  - o Taking responsibility for learning? ☐ Yes ☐ No

<u>Role of Instructor</u>

- Is the instructor
  - o Facilitating learning rather than directly teaching?
    ☐ Yes ☐ No
  - o Encouraging student ownership of the process? ☐ Yes ☐ No

The CPSRT promotes cognitive flexibility, a key component of the constructivist approach

In contrast with the IPSRT tool, which provides a checklist for necessary elements of a instructional plan, the CPSRT tool offers a reservoir of suggestions from which users can choose (Baylor & Kitsantas, 2001). The prompt questions in this tool do not provide definitive answers, but rather offer a space for users to expand their creativity and imagination within the framework of constructivist principles. The flexibility provided by the CPSRT tool is consistent with the less-structured and activity-based characteristics of the constructivist instruction.

The following excerpt about learning activities illustrates the flexibility of the CPSRT tool. An activity will be considered desirable for constructivist learning if any or all of the boxes are checked. The list of the check box questions provides various options for the user to choose or/and build upon. Pre-service teachers will not feel limited by having to come up with only one specific type of activity. Instead, they conveniently have a list of different types of appropriate characteristics for the instructional activities.

Desirable Characteristics

Are the activity(ies):

- Ill-structured tasks? ☐ Yes ☐ No
- Complex? ☐ Yes ☐ No
- Multi-disciplinary? ☐ Yes ☐ No
- Involving cognitive conflict? ☐ Yes ☐ No
- Including discussion and/or collaboration? ☐ Yes ☐ No

Conclusions

We found that the two tools improve instructional planning performance for plans developed according to the systematic (IPSRT) and constructivist (CPSRT) approaches (Baylor & Kitsantas, 2001). Further, anecdotal evidence of the value of the tools includes comments from the undergraduate pre-service teachers who, after using the tools, wondered why they were not provided earlier in the course!

While both tools assist in all phases of instructional planning, they place a strong emphasis on assessment. Given that assessment is strongly emphasized as a critical factor in teacher-education programs, these tools encourage pre-service teachers to seriously consider assessment, the last phase of the instructional plan. For example, the IPSRT assists them to monitor and self-evaluate their assessment procedures, e.g., does the assessment reflect the objectives of the instructional plan? The CPSRT similarly requires them to directly link the assessment to the instructional purpose and involve the learner in appropriate performance(s).

Overall, the IPSRT and the CPSRT are useful cognitive tools for pre-service or possibly in-service teachers to promote the effectiveness of their instructional planning in a self-regulated approach. If utilized appropriately, these tools can bring about increased motivation, intellectual challenge, reduced workload, and improved performance for both pre-service and in-service teachers.

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Student Satisfaction in an Online Master's Degree Program in Instructional Technology

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Abstract

In 1999, the University of West Florida launched an online Instructional Technology master's program. Students enrolled in this online program can be divided into two groups: 1) "local" students who, for various reasons, prefer the online courses, and 2) students at a geographical distance. The purpose of this study was to identify factors influencing the satisfaction of these students with the online courses. A second purpose was to ascertain any difference in satisfaction levels between the two groups. The Biner instrument (1993) was modified to accommodate questions relating to online courses. Fifty-two respondents from a sample of 200 participants completed the online survey. The results indicated student satisfaction in online courses is influenced by three constructs: instructor variables, course management, and technical issues. The statistical analysis did not reveal significant differences in satisfaction between the two groups. However, when the researchers compared the differences in distribution of responses between the two groups, some interesting differences were found.

Introduction

Distance learning is defined as instruction where "students and teachers are separated by distance and sometimes by time" (Moore & Kearsley, 1996, p. 1). Many higher education institutions today are either offering online courses and degree programs or are planning such initiatives. In 1997-98, 34% of postsecondary educational institutions offered distance education courses and 20% planned on offering distance courses by 2000. Of these institutions, 77% indicated they used the Internet as one of many instructional delivery modes (National Center for Education Statistics [NCES], 1999). Many universities now offer a wide range of online courses and degree programs (Laws, 1996). For example, in 1994-95, 51% of postsecondary educational institutions in the U.S. offered more than ten distance education courses; only 4% did not offer this type of courses (NCES, 1998).

Enrollment in these courses has increased dramatically in the 1990s (Neeley, Niemi, & Ehrhard, 1998). In the academic year 1994-95, formal online student enrollment was 758,640 (NCES, 1998). By 1997-98, that number had increased to 1,661,100 (NCES, 1999). The growth in distance education is largely credited to the availability of technology-enhanced instruction (Hobbs & Christianson, 1997).

Historically, retention of distance learners has been problematic with dropout rates disproportionably high compared to traditional course settings (Richards & Ridley, 1997; Wetzel, Radtke, & Stern, 1994). A dropout rate of 30 to 50 percent was not uncommon (Moore & Kearsley, 1996). Students may experience feelings of isolation in distance courses compared to prior face-to-face educational experiences (Shaw & Polovina, 1999) because of limited contact with instructors and fellow students. The result of this isolation can be unfinished courses or degree programs (Keegan, 1990).

Student satisfaction in traditional learning environments has been overlooked in the past (Astin, 1993) and has not been explored sufficiently (DeBourgh, 1999; Navarro & Shoemaker, 2000). Student satisfaction has also not been given the proper attention in distance learning environments (Biner, Dean, & Mellinger, 1994). Many current distance learners are "non-traditional students"—adults who have important commitments such as raising a family and maintaining full-time employment (Richards & Ridley, 1997). Non-traditional learners may differ from traditional learners in reporting satisfying experiences. According to Donohue and Wong (1997), further research should be conducted to investigate causes of satisfaction in non-traditional students. Richards and Ridley (1997) also suggest further research is necessary to study factors affecting student enrollment and satisfaction.

Prior studies in classroom-based courses have shown there is a high correlation between student satisfaction and retention (Astin, 1993; Edwards & Waters, 1982). Studies in which distance learners were the target population have yielded similar results (Bailey et al., 1998).

Many studies comparing distance education to traditional face-to-face instruction have focused on factors such as attrition, effectiveness, locus of control, different media, and student achievement (Bailey, Bauman, & Lata, 1998; Navarro & Shoemaker, 2000; Richards & Ridley, 1997; Sankaran, Sankaran, & Bui, 2000; Schutte, 1996; White, 1999; Wideman & Owston, 1999). However, research comparing "local" distance learners (those who could attend on-campus classes) to students who are geographically "distant" is limited.

In August of 1999, the University of West Florida (UWF) launched an online Master of Education degree program in instructional technology. Faculty members who teach these online courses employ a full complement of tools and strategies. Students enrolled in this online program can be divided into two groups: 1) local students, and 2) students at a geographical distance. The purpose of this study was to identify factors influencing the satisfaction of these students with the online courses. A second purpose was to identify any difference in satisfaction levels between the two student groups.

Review of Literature

Student Satisfaction

Most college students spend considerable time, money, and effort in obtaining a quality education and perceive their postsecondary educational experiences as being of high value (Knox, Lindsay, & Kolb, 1993). Satisfaction is an important "intermediate outcome" (Astin, 1993, p. 278). Student satisfaction is important because it influences the student's level of motivation (Chute, Thompson, & Hancock, 1999; Donohue & Wong, 1997) which is an important psychological factor in student success (American Psychological Association [APA], 1997). Bean and Bradley (1986) found student satisfaction has a significant effect on performance. Conversely, performance does not affect student satisfaction.

According to experts, satisfaction is a good predictor of academic success (Donohue & Wong, 1997) and retention (Astin, 1993; Edwards & Waters, 1982). Elliott (1999) notes postsecondary educational institutions must retain existing students in order to achieve the goal of maximum growth. Therefore, educational institutions must focus on student satisfaction in order to increase retention (Astin, 1993). A postsecondary educational institution may also use student satisfaction as one measure of its success (Knox et al., 1993).

Student satisfaction can be defined as the student's perception pertaining to the college experience and perceived value of the education received while attending an educational institution (Astin, 1993). However, a problem exists with measurement of this important outcome (Williams & Ceci, 1997). Course evaluations, which usually intend to measure the student's satisfaction with a course, may not be valid instruments. For example, in a study students rated the instructor's content knowledge based on perceptions of enthusiasm and on presentation style. They rated the course based on how much they thought they had learned, which did not actually correlate with the amount they had learned. The researchers also reported the overall course rating was strongly correlated with the final grade received in the course. Despite these problems, surveys administered to distance learners after a course has been completed can give evaluators valuable information pertaining to satisfactory or unsatisfactory aspects. In turn, this information can then be used to improve the course or program (Chute et al., 1999).

Distance Education

Many advantages and disadvantages exist for distance learners. A key advantage is convenience and flexibility for learners. This is particularly true for adults who must schedule coursework around family and career obligations. Distance education courses are often self-paced. With the use of asynchronous communication tools, learners have access to content, instructors and classmates at all hours (Belanger & Jordan, 2000). Another advantage for online learners is they have more time to reflect and formulate their responses in chat rooms or threaded discussions compared to learners in a classroom-based course (Moore & Kearsley, 1996). This particularly benefits students who may be reluctant to speak in a classroom setting.

Students with limited access to higher educational opportunities also benefit from distance education. Learners who live in remote or rural areas or who are restricted in mobility can access online courses. Others may need access to specialized courses, degree programs, or professional certificates not available in the area in which they live. Some students may not want to attend the local colleges or universities, and distance education gives them a choice of institutions to attend. Another advantage includes the increased access to experts in the field via telecommunications (Belanger & Jordan, 2000; Hara & Kling, 2000).

Disadvantages for the learners are loss of direct interaction with the instructor and possible loss of motivation to complete the course or program (Belanger & Jordan, 2000). When students are not familiar with the technology used in the course, it can be difficult for them to catch up with the rest of the group (Vrasidas & McIsaac, 1999). It can also be difficult to enable effective group collaboration and discussion. Access to resources such as the campus library can be problematic as well. In addition, the potential for disruptive technical problems is an important factor (Belanger & Jordan, 2000).

Software programs used to facilitate collaborative learning have been used successfully in online courses. Navarro (2000) reports many students are highly satisfied with online courses. Hiltz (1993) reports that communications software increased the quality of instruction, raised students' level of motivation due to greater access to instructors, and increased their satisfaction with outcomes. Powers, Davis, and Torrence (1999) also report high student satisfaction with their level of involvement in a graduate instructional technology course.

In a study by Bower and Kamata (2000), 84% of students indicated they were highly satisfied or satisfied with their online courses experience. Richards and Ridley (1997) found the majority of students who completed online courses were satisfied with their experiences and rated courses comparable to classroom-based course. In a study comparing an online and traditional introductory psychology course, researchers found students in the online course were satisfied with the course and rated the communication with the instructor as better than in a classroom-based course. However, the students in the classroom-based course indicated they were overall more satisfied than students in the online course (Maki, Maki, Patterson, & Whittaker, 2000).

Some studies have reported decreased student satisfaction in online courses. Online students have reported needing to work harder in an online course compared to a course in the traditional setting (Maki et al., 2000). Students have also reported anxiety, confusion, and frustration with online courses (Hara & Kling, 2000). Some students reported feeling isolated and they had problems overcoming the distance (Wegerif, 1998).

Factors Contributing to Student Satisfaction

In traditional settings, areas associated with student satisfaction are student characteristics, quality of relationships with faculty, curriculum and instruction, student life, support services, resources, and facilities. A study with undergraduate students by Astin (1993) identified the following factors as most important: contact time with faculty members and administrators, availability of career advisors, student social life on campus, and overall relationships with faculty and administrators. Bean and Bradley (1986) concluded the best predictors of student satisfaction are academic integration, institutional fit, quality and usefulness of education, social life, and difficulty of program.

The instructor is the main predictor in course satisfaction (Finaly-Neumann, 1994; Williams & Ceci, 1997). Student satisfaction is highly correlated with the performance of the instructor, particularly with his or her availability and response time (DeBourgh, 1999; Hiltz, 1993). Instructors must be available if students have questions and must be flexible (Moore & Kearsley, 1996). The instructor not only becomes a facilitator of learning but also a motivator for the student.

The instructor's feedback is a key factor in satisfaction with the instructional environment (Finaly-Neumann, 1994). Feedback on assignments must be given in a timely manner to keep learners involved and motivated (Smith & Dillon, 1999). Communication must be on a regular basis (Mood, 1995). Otherwise, students can experience a great level of frustration (Hara & Kling, 2000). Distance learners can experience feelings of isolation, and high levels of frustration and anxiety if communication and interaction between the different parties are lacking (Mood, 1995).

Mood (1995) reports that course goals and objectives should be clearly communicated to the students at the beginning of the course. If students know what is expected of them, their levels of anxiety can be reduced. Instructors should encourage student participation, provide updated information, and monitor student progress. Students should also have opportunities to become self-directed learners and structure their own learning experiences (Wegerif, 1998).

Students must have access to reliable equipment (Belanger & Jordan, 2000). Students with limited access are at a considerable disadvantage to learners who have unlimited access (Wegerif, 1998). Access is one of the most important factors influencing student satisfaction (Bower & Kamata, 2000). Online learners must be familiar with the technology used in the course in order to be successful (Belanger & Jordan, 2000). Students who experience frustrations with technology in a course report lower satisfaction levels (Chong, 1998; Hara & Kling, 2000).

Navigational components are also important issues in the online environment. Learners should be able to move within the course Web site without getting lost (Aggarwal, 2000). Hyperlinks must work properly or students will experience frustration (Harrison, 1999).

Learning environments in which social interaction and collaboration are allowed and encouraged lead to positive leaning outcomes (APA, 1997). Collaborative learning tools can improve student satisfaction in the online learning environment (Bonk, 1998; Gunawardena & Zittle, 1998). These tools allow for group work and immediate feedback. Students are able to share viewpoints and discuss them with one another in a virtual environment, thereby gaining insights and perspectives they otherwise would not have been exposed to. This type of environment allows for social interaction and creates meaningful, active learning experiences (Bonk, 1998).

Methodology

The University of West Florida was founded in 1963 and is located in the Florida Panhandle. The main campus is located in Pensacola, Florida. In 1993, the Fort Walton Beach campus was established approximately 50 miles east of Pensacola. The university offers many courses utilizing two modes of distance learning including online courses and interactive video courses.

Total university enrollment is approximately 9,000 students.

In 2000-01, the university's total enrollment was 8,517 students. Graduate and doctoral students make up 16% of the student body. The College of Professional Studies has 791 masters and doctoral students (University of West Florida, 2001).

Sample

The sample used in this study was drawn from a pool of all graduate distance learners (507 students) at this university. The researchers decided to split the population in two groups: "local" and geographical "distant" students. Zip codes of students' residences were used to make the distinction between the two groups of students. A "local" student was defined as anyone with a zip code starting with "325". A "distant" student was defined as anyone with any other zip code. The use of this criteria resulted of a sample of 363 "local" and 144 "distant" students. A total of 100 students were randomly selected from each of the two groups.

Instrument

The Telecourse Evaluation Questionnaire (Biner, 1993) has a total of 42 questions. This instrument measures student attitudes toward televised distance education and addresses three factors: (1) instruction and instructor, (2) technology, and (3) course management. With permission, the researchers modified the survey to address issues related to the online environment and student satisfaction. In order to eliminate neutral responses, participants were asked to indicate their level of satisfaction on a 4-point Likert scale ranging from "1 = strongly disagree" to "4 = strongly agree." The researchers added several questions relating to general information such as age, major, final course grade, hours per week spent on the course, and Internet access issues. The researchers also added four open-ended questions, asking the most and least satisfying aspects of the course, reason for enrollment, and factors that could improve student satisfaction. Because this survey was significantly modified to adapt the technology used in Web-based courses, the researchers performed a reliability analysis after the data collection phase.

Data Collection

The online survey was constructed and uploaded to a server. A personalized e-mail was sent to the participants with instructions on accessing and completing the survey. The researchers provided participants with the purpose of the research, a statement addressing confidentiality and voluntary participation, and contact information of one of the researchers. Initially, the return rate was 21.5%. After six days, all participants were reminded via e-mail to complete the survey, which resulted in a final response rate of 26% (52 participants).

Data Analysis

The data was examined for statistical assumptions (e.g. sample size and missing data, linearity, multicollinearity, singularity, univariate and multivariate outliers). None of the cases had missing values. Each group was examined separately for outliers. Examination of the scatterplots revealed no univariate outliers. A Mahalanobis distance test, $?^2 = 22.46$ at $p < .001$, was performed and no multivariate outliers were detected. In order to examine for linearity, several bivariate scatterplots were generated and examined. All of the scatterplots revealed abnormalities between the variables due to the instrument being a 4-point Likert scale.

The Pearson correlation coefficients were examined in a correlation matrix in order to determine if multicollinearity existed. Many correlation coefficients exceeded .50 and the highest correlation coefficient detected in this matrix was .91. The collinearity diagnostic demonstrated variance proportions were below .64 and this leads to the conclusion that no multicollinearity existed between any of the dependent variables. Each dependent variable was an independent measure, therefore ruling out singularity.

A confirmatory factor analysis was performed to subtract factors relevant to student satisfaction as identified in the literature and to examine the construct validity of the satisfaction survey. The researchers expected six factors with high subscale loadings for the online course satisfaction survey. An initial examination of the data revealed eight dimensions which had eigenvalues greater than 1. The examination of the scree plot, however, indicated the instrument has only three components.
The factor loadings on the instructor/instruction satisfaction dimension were satisfactory and explained 50.12% of variance. The other two components had several complex loadings. A possible explanation is students associated many of the course management aspects with instructional issues and the online learners might have associated technology aspects with factors outside the course. However, these results indicate the online course satisfaction survey is a true measure of satisfaction.

Descriptive measures were calculated for each item on the online course satisfaction survey. A *t*-test for independent samples with an alpha level of .05 was performed to determine if differences in responses between groups were statistically significant. The survey was then collapsed into six subscales: instructor, technology, course management, course Web site, interactivity, and general issues. Respondents' scores were summarized and divided by the number of questions in each of the subscales and a multivariate analysis of variance (MANOVA) was performed. Then, the subscales where collapsed again without dividing the computed scores in order to avoid losing variance and a MANOVA was performed a second time to detect statistically significant differences between the two groups. The data analysis also involved open coding of qualitative data generated with the use of open-ended questions.

Results and Discussion

The internal consistency reliability of the online course satisfaction survey was determined using the Cronbach alpha coefficient. The overall reliability of the modified instrument was high (.97).

General Survey Responses

Fifty-two students who had completed at least one online course responded to the Web-based survey. Of the respondents, 69% were female. The majority of learners were between 40 and 49 years of age. All but two respondents were Education majors. Most respondents (53.8%) lived within a 30-mile radius from a UWF campus. Twenty-one percent indicated they enroll only in distance learning courses.

Half of the participants had taken only one or two online courses at the time of completion of the survey. The participants spent an average of 12 hours per week working on course activities. The large majority of participants (86.5%) accessed the course materials from home.

Forty-six percent of the respondents indicated that they would have been able to take a course if it had not been offered online. When asked why they enrolled in an online course, the majority of participants indicated availability and degree requirements were the most important reasons, followed by convenience, and out-of-town travel during the semester. These findings are consistent with results of previous studies, in which students' reasons for enrolling in an online course were convenience, the ability to take a course which would otherwise not have been available to them, or fulfilling degree or certificate requirements (Bower & Kamata, 2000).

According to respondents, the three most satisfying aspects were acquisition or improvement of technology skills, instructor's support and responsiveness, and flexibility. The top two least satisfying aspects were lack of face-to-face contact with the instructor and students, and heavy workload. When asked what would increase satisfaction in the online course, several students responded that they could think of nothing, and they were satisfied and enjoyed the course. Some students indicated that the university should ensure students have the necessary computer skills before allowing them into online courses.

Overall online course experience

Eighty-four percent of respondents indicated they were satisfied with the online course. Fifty-six percent were more satisfied with the online course than with a classroom-based course, and 73.1% were satisfied with the course workload. Eighty-one percent stated they would enroll in another online course. Ninety percent were satisfied with their final grade, and 90% received a final grade of "B" or higher.

Ninety percent of respondents strongly agreed or agreed with positive statements about their satisfaction with aspects of online courses such as quality of lessons, instructor's content knowledge, opportunities to participate, reliability of the university's server, course registration procedures, and external hyperlinks used in the course. Satisfaction with the instructor, reliability of computer equipment, Internet connection, administrative issues, access to resources, and course web site was indicated by more than 80% of the respondents.

Less than 25% of respondents indicated dissatisfaction with instructor feedback and teaching methods, Internet communication tools, availability of course mentor, Web site's organizational structure, and personal familiarity of technology tools used in the course. However, 58% did not agree there was more interaction between all involved parties in the online course and 48% strongly disagreed or disagreed they participated more in the online course than in a traditional classroom setting. In addition, 31% were not satisfied with the effectiveness of communication in the online course.

Differences Between Local and Distant Learners

The "distant" group consisted of more females than the "local" group: 81% and 61% respectively. Of "local" learners, 90% lived within 30 miles from a university campus. None of the "distant" students lived closer than 31 miles to a campus and the majority of this group (52%) lived between 31 to 100 miles from a campus. In the "local" group, 13% indicated they only enrolled in distance education courses, whereas one third of individuals in the "distant" group were enrolled in only distance learning courses.

None of the "local" students had taken more than nine online courses. In comparison, 20% of "distant" students had taken more than nine of these courses. Almost two thirds of "distant" students and one third of "local" students would not have been able to take the course had it not been offered online. The majority of "local" students spent more time working on the course. Of "distant" students, 67% spent between one to ten hours per week working on the course, whereas 54.9 % of "local" students spent more than ten hours.

The majority of "local" learners (45.2%) did not experience difficulties accessing the Internet. In contrast, the majority of "distant" learners (42.9%) had problems between one to three times. Of students who answered what grade they had received in the course, only two students received a grade C. These two students were "distant" students. All other students received a grade B or better.

Overall online course experience

The statistical analysis revealed no statistically significant differences between the means of the two groups at the $r < .05$ level. The standard deviations are relatively minor. Variables with a correlation coefficient between .60 and .80 are considered to have a strong relationship, whereas variables with a correlation coefficient between .80 and 1.00 have a very strong relationship. In Group 1, there were six relationships with a correlation coefficient higher than .60; in Group 2, six relationships with a correlation coefficient above .60 and nine relationships above .80 were detected.

When the researchers compared the differences in distribution of responses by percentages ("strongly disagree" and "disagree" versus "agree" and "strongly disagree") between the two groups, some interesting differences were found. "Local" students were generally more satisfied than "distant" students with a few exceptions. "Distant" students disagreed far less with the statement there was more interaction between all involved parties in the online course.
The "distant" group was also more satisfied with the online course compared to a classroom-based course. The technology used in the course was more familiar to them and they were more satisfied with the use of threaded online discussions or forums. In addition, they were slightly less negative about the statement they participated more in the online course than in a traditional classroom setting and were slightly more satisfied with the instructor's use of various teaching methods and techniques.

In general, "local" students were more satisfied with the opportunities given to them by the instructor to participate in the course, the instructor's communication skills, and the instructor's organization and preparation. They also indicated the instructor made them feel more like they were part of the class and belonged, and they were more satisfied with the instructor's encouragement. They agreed more with the statement the Web site was consistent and well designed and their Internet service provider was reliable. Interestingly enough, they were slightly more satisfied with the university's role in helping them get started in the course and with the accessibility of departmental program personnel. The "local" students were also more satisfied with their final grade in the course and with the quality of the weekly lessons.

Conclusions

Students in online courses face a number of obstacles. Online students who are geographically distant would theoretically have more to overcome than those who live near the institution and have ready access to the instructor, peers, and physical campus resources such as the library and computing center. This study found no statistically significant levels of satisfaction between local learners and truly distant learners in online courses. Truly distant learners did not experience less satisfaction in their online courses. Perhaps they experience more satisfaction than one would expect because they are accustomed to the technology and the environment. Perhaps they have extra motivation because they have no choice: they would not otherwise be able to take the required courses for their program of study and are therefore content with the online environment. The only alternative would be driving long distances to physical campuses to have the educational opportunities their local counterparts take for granted. This issue certainly requires further investigation.

Interesting conclusions we might draw from learners' responses to the open-ended questions are that the university should consider more preparation of students for online environment. This could be in the form of policies and procedures, orientations, and checklists of required equipment and skills. One thing an institution can provide for its distance learners is a handbook for distance students with basic institutional information, policies and procedures, and technological skills and requirements (Hardy, 1999). This is particularly important for learners who are being introduced to the online learning environment. Many of the respondents in this study had completed only one online course.

According to the participants in this study, the limited face-to-face interaction was a drawback. Perhaps it would benefit the students to schedule an in-person meeting at the beginning of the course, even though it would be potentially inconvenient for students. Because limited face-to-face contact was the most frequently cited issue that limited satisfaction, a one-time meeting and orientation for all class participants could address this problem.

One recommendation for further research is the investigation of differences in satisfaction between students who are enrolled strictly in online courses and others who take a mixture of Web-based and classroom-based courses. The sample in this study was not large enough to perform a statistical analysis because only 11 students were true distance learners. A small sample size such as this could be used for an in-depth case study with structured interviews.

Moore and Kearsley (1996) warn student satisfaction is not correlated with actual student achievement. However, the fact that satisfaction is a contributing factor in motivation, which, in turn, is a predicting factor of student success, is reason enough to be concerned about the levels of satisfaction students experience in online courses and degree programs. The increase in numbers of online courses offered at postsecondary institutions and the rising enrollment in these courses and programs should encourage researchers to investigate student satisfaction.

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Effects of Instruction Administered Through Written and Visual Symbol Systems on the Achievement of Formal and Distance Education Students

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Abstract

This study was conducted to examine the effects of instruction administered through written and visual symbol systems on the achievement, confidence, attitudes, time-on-task and retention of formal and distance education students.

The sample of the study consisted of 161 undergraduate students from formal and distance education settings. Subjects were divided into three groups and asked to study the materials during a week. First group studied the materials that included only written symbol systems, second group visual symbol systems, and the third group both written and visual symbol systems. After studying the materials, the subjects completed an achievement test and a Likert type attitude scale. Two weeks later, an identical achievement test was administered again to determine the retention of learning.

Results indicated that different forms of symbol systems had different effects on student's achievement, confidence, and retention of learning. Attitudes of subjects were positive toward the symbol systems that they studied. Especially, distance education students were positive toward both to written and visual symbol systems while formal education students were positive only to written symbol systems.

Introduction

Symbol systems in information processing are defined as symbolic representations of information and requires interrelation of varying symbol forms such as letters, numbers, formulas, figures, notes, graphics, photographs, etc (Goodman, 1976). Selection of symbol systems to use with different media depends on the nature of media and its technological limitations. Students' selection, processing, storage and recall of verbal, visual or aural symbol systems vary due to their individual differences.

Media in learning process show differences in cognitive information processing in relation to their capabilities, technologies and symbol systems (Kozma, 1991). In other words, an individual utilize varying schemata for defining, processing and storing symbol systems relevant to the characteristics of media.

The schemata in memory are coded either verbally or visually according to characteristics of symbol systems that carry information and recalled back to be used in process of learning new information. Learning occurs with processing of prior and new information in memory as an integrated entity. However, in some situations, new information may not fit into an existing schema and either a new one, appropriate for new information, is constructed or the existing schema is modified in a way that new information can suit. This modification to new information might be possible through gaining attention of students. Thus, symbol systems in instructional materials must be designed carefully to acquire students' attention (Wittrock, 1990).

In the light of this view and explanations of cognitive psychology about information processing, a shift happened in media comparison studies toward studying how learning occurs according to individual characteristics of students. So that it can be revealed how to implement instruction according to available technological facilities.

However, researchers in the field of educational technology have not reached a common consensus on which and how attributes of different media influence learning although debates have been continuing for many decades. Thus, more detailed studies are still needed to clarify this issue. This need is more crucial in the field of distance education that naturally depends on heavily mediated learning activities. The quantity and quality of research studies have done on effects of media on distance learning urges the need.

This study was conducted to examine the effects of instruction administered through written and visual symbol systems on the achievement, confidence, attitudes, time-on-task and retention of formal and distance education students. It is believed that results of the study may help especially distance learning designers and instructors provide more effective, efficient and appealing instructional media to their students.

Purpose of Study

In this investigation, it was sought to clarify the effects of using different media in both distance and formal education on learning outcomes. In other words, this study purposed to determine which symbol systems provide better achievement, higher confidence, lesser time-on-task, positive attitudes, more retention of learning, when used in distance and formal education settings. Specifically, the following research questions were addressed:

1. In which way is the use of different media and symbol systems effective on achievement of students in distance education and formal education?
2. How do distance and formal education students' attitudes toward the media they use and the content they encounter differentiate?

3. How does the use of different symbol systems influence confidence level toward achievement and retention in distance education and formal education settings?
4. Does the time students spend to complete the task differ according to instructional strategy (distance and formal) and symbol systems?
5. In which way is the use of different symbol systems effective on the retention of learning?

Methodology

This investigation included a 2X3 factorial analysis. The factors can be seen in Table 1. The effects of these dependent variables on formal and distance students' achievements, levels of self-confidence, academic attitudes, time-on-tasks and retention of learning, which is determined at the second test administered two weeks later the first one, are investigated in this study.

Table 1. Factors and Quantity of Participants

Instructional Strategies	*Symbol Systems*: Written	Visual	Written and Visual	
Distance	n = 28	n = 31	n = 28	87
Formal	n = 25	n = 24	n = 25	74
	53	55	53	N = 161

The sample of study consisted of 161 sophomore students from formal and distance education settings. 87 of these were formal education students majoring in Economics and Business Programs of Anadolu University. Others were also studying in economics and business but they were all in the distance education programs of the University.

A 138 minutes long video program and a 50 pages textbook on same topic, anthropology were used in as the instructional materials of this study. Subjects were divided into three groups and asked to study the materials during a week. First group studied the materials that included only written symbol systems, second group visual symbol systems, and the third group both written and visual symbol systems. It was also asked students record the time they spent on studying the materials. After studying the materials, the subjects completed an achievement test and a Likert type attitude scale. Two weeks later, an identical achievement test was administered again to determine the retention of learning. In addition to these, students indicated their grade expectations on both achievement tests. These were used to determine the self-confidence level of students.

In the process of data analysis, means, standard deviation, Pearson correlation, two way variance analysis and Fisher LSD test were used. Using MS Excel and Systat software completed all these statistical processes. For data analysis .05 Alpha level determined but it was also indicated when a .01 Alpha level determined.

In order to determine the effects of using different symbol systems (written, visual or combination of these) on distance and formal education students, five different instruments about achievement, self-confidence, attitudes, time-on-task and retention of learning were developed.

- **Achievement test:** After studying the materials participants took a 50 items achievement test. 50% of these items were intended to measure students recalling abilities others were comprehension abilities.
- **Self-confidence:** The students were asked to write down what grade they expect to get in the exam before they started to answer the questions. These expectations were used as their confidence levels.
- **Time-on-task:** It was demanded to keep a record of time spent for studying the materials. So that, whether a statically significant difference are there between in time spent for studying and instructional strategy (distance versus formal) or symbol systems through a two-way variance analysis.
- **Attitudes:** A 30 item Likert type instrument were developed to determine the students' attitudes toward symbol systems and the topic they studied. 15 of the items were related to the instructional media and others were about the content.
- **Retention of learning:** Two weeks later, an identical achievement test was administered again to determine the retention of learning. Same as achievement test, it was intended to determine if there is any difference between in the recalling and comprehension levels of students.

Results and Discussion

The results reached in this investigation are given below into four groups.

Achievement

Results indicated that students in face-to-face education achieved more than the students in distance education. While the groups studying only with the written symbol systems in face-to-face education are more successful, in distance education the groups studying with both written and visual symbol systems together are more successful. This finding might be implying that students use their usual learning styles when they are presented the content in a different material. In other words, using textbooks in face-to-face education as a basic resource results in students' preferring the textbooks and written symbol systems. On the other hand, the fact that students using both written and visual symbol systems in distance education are more successful comparing the other two groups may be caused by their familiarity to the media and determination of which symbol systems to use (Weinstein and Mayer, 1985).

While the remote memorization part of the achievement test imply almost the same results, the comprehension part of it, on the other hand, yields a significant difference. In the comprehension part of the achievement test, those who use both written and visual symbol systems in both traditional and distance learning are more successful than other groups. Research findings related to the effects of presentation of content via different materials and different symbol systems support the literature in general. For example, Bagget and Ehrenfeucht (1983) believed the strength of the use of verbal and visual symbol systems together in increasing the achievement. Also, Pezdek and Hartman (1983) suggest that using audio-visual information together increases the achievement, while Pluss, Leutner, Chu, and Mayer (1998) suggest visual and verbal elaboration in information processing increases the achievement. But these findings have been gathered from the learners in traditional education. On the other hand, findings of this research shows that the students who use only the written symbol systems in face-to-face education scored the highest points on the achievement test. This might be implying that the students in traditional learning usually prefer verbal learning habits in order to create connections in between their previous and new learning.

Confidence

Confidence score means of the students in face-to-face education are higher than those who are in distance education. Correlation between achievement scores and confidence scores was found to be positive and significant.

Research findings, on the other hand, show that there is a difference between successful groups and confidence levels. From the achievement perspective, the group using written symbol systems in traditional education is more successful than the group using both written and visual symbol systems in distance education. From the confidence perspective, the groups using only visual symbol systems had higher confidence levels in both traditional and distance education. This might be an indication of students' perception of visual symbol systems easier and finding the presentation of content more attractive.

Salomon (1979, 1984) compared the printed materials and television in his researches,, and suggested that television is perceived much easier compared to printed materials, but still the learning is not that strong. Similarly, Cennamo, Savenye and Smith (1991) suggest that the way students perceive the medium will make their learning either easier or more difficult depending on their abilities. In this research also, findings support that groups using only the visual symbol systems had higher confidence levels since they perceived the medium much easier.

Attitudes

Attitude score means of students in distance education are rather close to the means of students in face-to-face education. Overall attitude scores for all students are generally high. It can be said that students' attitudes toward the instructional media and content are positive.

In the media part of the attitude scale, both the written symbol systems and written-visual symbol systems groups showed more positive attitudes compared to only visual symbol systems groups. This finding yields important clues for instructional designers, teachers, program producers and textbook writers. Because adaptation to any content can only be possible by focusing on the media. This requires the design of learning materials and symbol systems in a way that they will get their attention and attract them (Wittrock, 1990).

In the content part of the attitude scale, only written symbol systems groups and written-visual symbol systems groups in distance education exhibit more positive attitudes in understanding the content. This shows that in distance education, only the visual symbol systems are not enough to affect achievement. This finding supports Pezdek and Stevens (1984).

On the other hand, groups studying only with the written symbol systems in traditional education, exhibit more positive attitudes in understanding of the content. This implies that the book is the most effective material for understanding the content. This finding supports Salomon (1984). According to him, printed materials are perceived to be requiring more efforts and investment.

Time-on-task

The time students spent on completing the instructional materials are significant in both teaching method and symbol systems variables. Distance education students spent more time than the traditional groups. Groups using written and visual symbol systems together spent more time than those using only written or only visual symbol systems. To see how these two variables effect each other, Fisher LSD test processed and according to the results, distance learning groups in both written and visual symbol systems compared to other five groups. Traditional face-to-face group spend less time to complete the material than other groups.

Looking at their achievement score means, results show that there is a positive correlation between time-on-task and students' achievement in distance written and visual groups. While the traditional written symbol group use less time for learning, still they are more successful comparing to other groups. The reason for this success of students in this group might be related to their ability levels and entry learning behavior levels. Different researches in the literature suggest that learning content from different materials and symbol systems might change as a result of their entry behaviors and abilities of students.(Eckhardt, Wood and Jacobwitz, 1991; Van der Molen and Van Der Voort, 1997; 1998). This effects student achievement either positively or negatively.

Future research is needed to see whether the findings are correlated to entry behaviors and abilities.

Result of the retention of learning test was conducted two weeks after the achievemet test. The test indicated that each group's achievement points were decreased. Formal students were more successful than the distance students at the retention test. If we look at the symbol systems' point of view, formal group students who have used symbol systems were more succesful than the other groups. Distance education students who have used the verbal and video symbol systems were more succesful than the other groups.

Recall sub division of the retention test's statistical results indicated that there were some differantiation between the achievement tests' sub divisions. Formal–verbal was the most successful group in the context of achievement-recall. In conrats verbal-visual group were the most succesful in vebal-visual context. Those results supports that the idea of visual knowledge can be stayed more than a week in memory (Bagget and Ehrenfeucht, 1983), and if visual-verbal knowledge can be presented together those knowledge effects the students' achievement (Plass, Lautner, Chun, and Mayer, 1998).

Formal written group is seen the most successful group in the comprehension sub division of retention test while the formal written and visual group is the most successful in the comprehension sub division of achievement test. On the other hand, the formal education learners' interaction level with symbol systems reveals that formal written group is more successful in retention-comprehension while formal written and visual group leads in achievement-comprehension. These findings can be interpreted as that formal education learners use mostly use verbal strategies in the mental information processing.

The responds of students related to confidence show no significant difference neither for instructional strategy nor symbol systems. Decreases can be seen in the relationship between students' actual grades and indicated confidence responses, and retention-confidence level of each group compare to achievement-confidence. Positive and significant relation between in the retention test grades and in confidence grades is also observed same as relation between achievement and confidence.

Another decrease can also be noticed in each groups' means of confidence level related to retention test when achievement-confidence means of the groups and the means of confidence level related to retention test are compared. Same as achievement test confidence means, groups studied only visual symbol systems got better confidence scores than others. According to these findings, it can be claimed that visual materials are perceived easier than printed materials.

In the light of all the findings indicated above, it can be told that use of different symbol systems for learners in formal and distance education settings shows assorted effects on learners' achievement, attitudes, confidence, time-on-task and retention of learning. So that, in order to enable learners with diverse characteristics to get benefits from various symbol systems, instructional media must be designed and utilized appropriately.

Suggestions

According to the results of this investigation and the experiences gained during the study, following suggestions are offered for both practitioners and researchers.

Different symbol systems do influence the achievement in different ways. So that, instructional designers (practitioners) should pay attention to learners' individual characteristics and distinctiveness of symbol systems in order to provide effective, efficient and appealing distance learning opportunities as well as formal learning practices in every phases of instructional design process.

As with any research effort, this one raised a number of compelling questions worth further exploration. First, distance learners' individual characteristics such as age, sex, learning style might influence the effective use of different symbol systems. Thus, people who are interested in symbol systems (researchers) in distance education can investigate the relationship between these characteristics and symbol systems.

Second, effects of learners' prerequisite skills about instructional content on distance learners' symbol system preferences is another topic worth further investigation. Third, the instructional content of this study was a social science, anthropology. The effects of symbol systems might differ on another instructional content. In other words similar investigations should be conducted in different content areas such as sciences, mathematics.

Forth, another point is that sometimes learners might find the content more important than the symbol system or vice versa. In another investigation this point might be examined to clarify in distance education.

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Community Colleges World Wide Web Home Pages: Accessibility and Design

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Abstract

The Carl D. Perkins Vocational and Technical Education Act of 1998 made the community colleges the point of access for training and education for special populations. Physical barriers are obvious problems that limit access for individuals with disabilities, and community colleges have made reasonable accommodations for individuals with disabilities. However, there are on-line barriers that limit Web-based content that have often been overlooked. This study examined the content accessibility of community college home pages. A total of 253 community college home pages were evaluated for content accessibility. Only 22.1% of the community college home pages were accessible to individuals with disabilities.

Introduction

Access and opportunity have become the hallmarks of post-secondary education. The community college extends far beyond the traditional, limited freshmen-sophomore experience and provides a setting where almost anyone can learn (Parlinchak, 1998). Community colleges serve all citizens and provide a range of services that support special populations. As the number of students continues to increase, especially among special populations, so does the need for support programs and services.

The Americans with Disabilities Act (ADA) of 1990 provides the same civil rights protection to individuals with disabilities that apply as a result of race, gender, national origin, and religion (Button & Wobschall, 1994). Title III of the ADA directs that public facilities make reasonable modifications to control discrimination and support accessibility in policies, practices, and procedures (Council for Exceptional Children, 1994). As a result of this landmark legislation, accessibility alterations such as providing ramps to elevated areas and providing accessible signage through height adjustments and raised lettering have become commonplace across the United States.

The Perkins Vocational Act of 1984 called attention to America's need to support individuals who were less fortunate by birth or economic circumstances. The Act underscored the need for improving vocational programs and serving special populations of students. The Act created an awareness of the population of people that had gone unnoticed with little or no training. This Act made community colleges the point of access for training and education for special populations.

The World Wide Web (WWW) has become an invaluable resource for many people with disabilities. Accessibility across platforms and geographic distance makes the WWW an ideal universal tool for gathering and disseminating information (Heflich & Edyburn, 1998). In fact, it is estimated that 34.4% of community colleges use the Internet to disseminate training and educational programs to special populations (Gibson, 2000). Wong (1997) discussed using the Internet for increased self-advocacy by individuals with physical impairments. It is ironic, however, that while technological developments have enhanced and provided new exciting opportunities for the WWW, they have, at the same time, complicated and limited the accessibility of the content and resources for individuals with disabilities.

Physical barriers are obvious accessibility concerns. Web page developers need to be just as aware that on-line barriers can create significant problems for some users. The Americans with Disabilities Act requires that all organizations make reasonable accommodations for individuals with disabilities. Even though there has not been a judicial ruling on WWW accommodations for individuals with disabilities, home page developers should work towards designing and building Web sites that are accessible to all individuals. It is important that Web page developers use and follow standards that allow accessibility to all WWW users.

A variety of disabilities can reduce accessibility to the WWW. Visual, hearing, movement, cognitive, speech, and other impairments can limit availability of information. Assisted technologies or accessibility aids, such as Braille output systems, keyboard modification, screen enlargement utilities, voice output utilities, and other technologies allow individuals with disabilities to access information on the WWW. However, because of the complexity of many Internet resources, some information cannot be accessed with these aids. Developers of accessibility aids continue to identify and develop features that can overcome some of these barriers, but there are many simple strategies that Web page developers can use with very little effort that would make their services more accessible.

The Trace Research and Development Center at the University of Wisconsin at Madison produced the Unified Web Site Accessibility Guidelines (Trace Research and Development Center, 1998). This information was transferred to the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) and used to produce the Web Content Accessibility Guidelines 1.0 (Chisholm & Vanderheiden, 1999a). The primary goal of the guidelines is to promote content accessibility. The guidelines do not discourage content developers from using images, video, and other multimedia tools; rather, they explain how to make multimedia content more accessible to a wide audience.

The Web Content Accessibility Guidelines 1.0 (Chisholm & Vanderheiden, 1999a) is organized around two general themes and 14 guidelines or general principles of accessible design. The themes are (a) ensuring graceful transformation and (b) making content understandable and navigable. The document provides the rationale behind the guidelines and includes some groups of users who benefit when they are applied to Web pages. In addition, a list of checkpoints is provided that explains how the guidelines apply to typical content development scenarios. Each checkpoint is specific enough to be verified, while general enough to allow Web developers freedom to use appropriate strategies.

The guidelines that primarily address the theme of ensuring graceful transformation, Guidelines 1 through 11, assist Web page developers in producing sites that remain accessible despite constraints confronted by people with disabilities. For example, Guideline 1 states that Web developers should provide equivalent alternatives to auditory and visual content. Text can be rendered in ways that are available to almost all browsing devices and accessible to all users, but auditory and visual content are not. Guidelines 12 through 14 primarily address the theme of making content understandable and navigable. This includes providing navigation tools and orientation information in pages with maximize accessibility and usability. Not all users can make use of visual clues such as image maps or graphical information, but with orientation information, users can understand many of these graphical images. The Web Content Accessibility Guidelines 1.0 document provides much more detail in developing content accessible Web pages (Chisholm & Vanderheiden, 1999a).

Building Web sites that comply with standards for accessibility should be a high priority for Web page developers. To date, little research has documented the extent to which accessibility goals have been reached. The purpose of this study is to examine the accessibility of community college home pages and provide information on making them accessible (if they are not) to individuals with disabilities.

Method

To examine the accessibility of community college home pages a descriptive study was conducted. The sampling technique used to select community college Web sites and the evaluation procedures are discussed in the following section.

Sampling

The population Web sites for this study was community colleges located in the United States. A list of 720 community college Web sites was generated using the search engine go.com (2000). A random sample of 260 community college home pages was selected for content accessibility evaluation in this study.

Procedures

Each home page was analyzed using the software package Bobby 3.2 (Center for Applied Special Technology, 2000), which allows researchers and other professionals to evaluate Web pages in accordance with the W3C Web Accessibility Initiative's guidelines. Bobby 3.2 produces a summary report that consists of (a) the number of Priority 1, Priority 2, and Priority 3 access errors, (b) user check data, (c) the types of accessibility errors, and (d) the ease in correcting the accessibility error. Priority 1access errors are problems that seriously affect the page’s usability by people with disabilities and the Center for Applied Special Technology (CAST) strongly suggest that Web developer correct these errors. For a page to obtain Bobby Approved rating, the home page cannot contain any Priority 1 errors. Priority 2 access errors are considered important for access but are not as vital as Priority 1. Priority 3 access errors are third-tier access problems that a Web developer should consider correcting.

Some accessibility errors cannot be confirmed using Bobby 3.2, but Bobby 3.2 provides user check data that informs the user that manual examination and human judgment are required for examining a specific area of the home page. For example, when different font colors are detected, Bobby 3.2 identifies multiple color fonts and reports this as a user check, meaning that it may potentially be an accessibility problem. In this study the user check data was not manually examined but will be reported as potential accessibility problems.

For a full description of the types of access errors see the Techniques for Web Content Accessibility Guidelines 1.0 (Chisholm & Vanderheiden, 1999b). In this study only the initial home page was evaluated; that is, no links from the home page within the domain were evaluated. Scores for each home page were tabulated and further analyzed.

Results

Of the 260 community college home pages randomly selected for this study, only 253 pages were available for evaluation. Approximately three-fourths (77.1%) of the home pages (n=195) were not approved by Bobby 3.2 (2000) as content accessible. This indicates that at least one Priority 1 error (seriously affects accessibility) was detected on these pages. There was an average of 1.01 Priority 1 accessibility errors on the community college home pages. In addition, the average number of potential Priority 1 accessibility errors was 8.48.

There were three types of Priority 1 accessibility errors detected on the home pages. Most of the community college home pages (64.2%) did not provide alternative text for all images. A few of the home pages did not provide alternative text for image map hot-spots (17.3%) and did not provide alternative text for each applet (5.5%). All the Priority 1 accessibility errors were rated as easy to correct.

Almost all the home pages (99.2%) did not identify the language of the text. Approximately 90% of all community colleges home pages (a) did not specify a logical tab order among form controls, links, and object, (b) did not provide keyboard shortcuts to links, (c) did not provide a descriptive title to links, and (d) used deprecated (i.e., included elements that have been replaced by newer elements) language features. Using tables in home pages create additional types of accessibility problems. Community college home pages used tables to format text documents in columns (77.2%), did not provide a linear text alternative for tables (81.9%), and did not provide a summary and caption for tables (77.6%). Many of the home pages used movement in their images (78.7%).

Using color on home pages can create problems in differentiating items on the page. Most of the pages needed examining for foreground and background colors contrast (92.1%) and used color fonts to convey information (87.4%). The majority of sites did not use an extended description to convey information beyond what was in the alternative text (84.2%). Again, the inclusion of tables on home pages could create potential accessibility problems. Most of the home pages needed to be examined for the use of structural markup to identify their hierarchy and relationship (80.7%) and examined for the presence of headers for the table rows and columns (72.4%). When scripts are used to convey information or functionality, alternative content needs to be provided (54.3%).

Discussion

Community colleges have played an important role in the training and education of individuals with disabilities. This study provides empirical evidence that most community college home pages are not accessible to individuals with disabilities. With very little effort all the home pages could easily be corrected to eliminate the more severe Priority 1 accessibility errors.

Web developers at community colleges need to examine their Web sites for accessibility problems. It is strongly recommended that validation methods be used in the early stages of Web development, which will help make problems easier to correct and assist developers in avoiding many accessibility problems. There are two suggested methods of validating a Web page for accessibility (Chisholm & Vanderheiden, 1999a). First, automatic tools are available for scanning the site and providing data. Bobby and other validation services should be used to provide information concerning accessibility problems. Automatic tools are convenient but do not identify all accessibility issues, therefore it is recommended that each site be examined by a knowledgeable individual and individuals with disabilities to ensure clarity of language and ease of navigation. The processes of rapid prototyping and formative evaluation have been used for many years to help develop educational software and have recently proven to be useful in the process of Web site development (Corry, Frick, & Hansen, 1997). Expert and novice users with disabilities should be invited to view home pages and provide feedback about accessibility or usability problems and their severity.

Community colleges are leaders in educating special populations. The WWW has become an invaluable resource for notifying special population students of services available at their institution. Creating home pages that are accessible to a diverse group of users would insure the universality of the WWW.

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Using Computers in the Classroom to Promote Generative Strategies for Reading Comprehension

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Abstract

Reading management programs have become very popular in elementary schools. Students select a title from a prescribed reading list then are tested for recall of facts and events in the story. Students are motivated to read as many titles as possible since they must achieve a certain score to win prizes. Although there have been reports that this increases voluntary independent reading, programs like Accelerated Reader® do little to increase comprehension or enhance reading instruction. Generative strategies use integration and organizational activities to increase both recall and comprehension of textual information. For this study, students were assigned two different book titles for independent reading. Using thinking maps, the students analyzed the information in the books, then used these to generate test questions for a mock Accelerated Reader test. The results show marginal differences between pre and posttest scores, however there was a significant improvement when students tested each other with their own test items. In addition, students' test items were aligned with the Levels for Thinking model used by the North Carolina Department of Public Instruction for end-of-grade tests for higher level thinking. Half of the student-generated test items matched higher level thinking categories. Students were able to generate multiple choice test items, distractors, and correct answers at a high level of thinking. Three models were used to compare student-generated and criterion reference test items: Generative strategies (Wittrock), Thinking Maps (Hyerle), and Dimensions for Thinking (Marzano).

Introduction

The Accelerated Reader®(AR) program is becoming increasingly popular in elementary, middle schools, and high school reading programs. Currently there are approximately 43,000 schools across the United States (Education Commission of the States, 1999) that use the AR software. Students choose from a list of titles that have been selected for their prescribed reading level then take quizzes to show mastery of content. Although these reading-management programs have contributed to an increase in voluntary reading, there are few reports (Mathis, 1996; Turner, 1993) suggesting that AR programs enhance comprehension or are useful as a tool for reading instruction. Most of the AR quizzes appear to measure recall of factual information only. Generative learning theory supports the use of cognitive strategies to promote improved comprehension in addition to recall of facts. There are a number of activities that could be considered generative. These include developing test questions, writing summaries from a passage of text, elaboration by developing a multimedia presentation, and analysis of content by generating charts and tables (Morrison, Ross, & Kemp, 2001).

Purpose of the Study

Voluntary independent reading may be increased through computerized reading-management programs, but the tests used by these programs are largely designed to measure recall of main ideas, characters, settings, and sequence of events in the story. If the reader does not gain a conceptual understanding of ideas and principles communicated in the books, tests similar to those administered through the reading-management programs, may not reveal deficiencies in comprehension. Research in generative learning theories have provided much evidence to support the use of generative strategies to increase comprehension of ideas and concepts, in addition to recall of facts. Comprehension of textual materials read during sustained voluntary reading sessions may be increased by combining two types of generative strategies.

First there are "organizational" strategies for the analysis and interpretation of textual information. Through the use of organizational charts, students analyze the ideas presented in a reading passage. Sentences, paragraphs, and chapters are distilled into basic ideas and concepts. The product of this analysis is displayed through visual tools such as bubble maps and flowcharts.

Second, there are "integration" strategies that use the integrative approach with student-generated test questions. Using their own thinking maps to interpret reading passages, students could generate test items consistent with higher level thinking processes similar to Dimensions in Thinking and those recommended by the North Carolina State Department of Public Instruction for end of grade tests. Students should be able to connect what they already know about a topic with the new ideas and concepts read in the text. Thus, three questions were generated to further investigate these strategies for teaching reading and writing comprehension; (1) can students generate test items consistent with higher level thinking processes similar to those recommended by NCDPI and Marzano's model for higher level thinking, (2) will the use of organizational strategies for generating original reading comprehension questions significantly affect student performance on a criterion referenced test for main idea, sequence of events, fact versus opinion, and cause/effect factors, and (3) will students perform better on a criterion referenced test than their own student-generated test for reading comprehension?

Review of the Literature

Generative Learning Theory (GLT) first appeared in the literature in the early 1970's (Wittrock, 1974). Since then, reports on the effective use of generative strategies for improving recall and comprehension skills for reading (Dunlap, 1999; Volk & Ritchie, 1999; Wittrock & Alesandrini, 1990; Wittrock, 1991) have continued to be published. GLT is based on brain research which suggests that neural processes for learning are deeper and more lasting when connections are made between prior knowledge and new information. Wittrock (1992) defines generative learning as a process that leads learners to see relationships, (1) across concepts and (2) between prior learning and new information. Evidence that these connections are meaningful can be found students' writings of summaries, metaphors, paraphrases, and outlines. These strategies all fit in one category for generative learning known as integration strategies (Volk & Ritchie, 1999). In a second type of generative strategy, students may use tools for analysis of textual material for the purpose of seeing relationships between ideas, concepts, or events in a reading passage. A variety of tools can be used to accomplish this analytic type of processing. These include students' generated charts, tables, graphs, and concept maps and are known as organizational strategies.

Thinking Maps

The use of visual tools for organizing ideas and concepts found in textual information has been reported as useful for helping students translate what they have read into graphic images. These are in the form of thinking maps. Hyerle (2000) has organized these thinking maps into eight primitive formats, circle map, bubble map, double bubble-map, tree map, brace map, flow map, multi-flow map, and bridge map. Each of the primitives is unique in form and purpose. There are a number of benefits for using the maps. By organizing information into the appropriate map, students are able to increase memory of factual information, gain deeper conceptual understanding, communicate abstract concepts, and enhance creativity for perception-taking.

Dimensions for Thinking

North Carolina has built higher order thinking skills into classroom activities in all content areas for K-12 schools (Houghton, 1994). (*Thinking Skill Levels*.
Available: [http://www.ceap.wcu.edu/Houghton/Learner/Think94/homeNCthink94.html]). These activities were developed along with accountability measures adopted by the state in the form of End-Of-Grade Testing (North Carolina, 1992-1993).
Activities for the classroom were planned around thinking skills levels developed by Robert Marzano (1988, 1992). Marzano's model is a framework for higher level thinking applied to specific strategies for the classroom. It contains eight categories: focusing, information gathering, remembering, organizing, analyzing, generating, integrating, evaluating. NCDPI curriculum specialists reduced these eight categories to seven by collapsing the subcategories for focusing, information gathering, and remembering to one category, "knowledge". Table 1 shows how generative strategies, as defined by Morrison, et al., (2001), compare with Hyerle's Thinking Maps and the NCDPI's adaptation of Marzano's model, Dimensions for Thinking.

Table 1 Generative strategies, Thinking Maps, and Dimensions for Thinking are compared as generative learning models.

Morrison, et al. **Generative Strategies** (based on Wittrock)	David Hyerle **Thinking Maps**	NCDPI adapted from Marzano's **Dimensions for Thinking**	Strategies for Teaching
Recall	Context/frame of reference	Knowledge	>Using drill and practice software, repetitive games with feedback **>Circle map** for brainstorming, defining words List attributes or list the steps in a procedure
Organizational	Describing qualities Compare and contrast Classification Whole/part Sequencing	Organizing Analyzing	>Using productivity software to generate charts, graphs, or tables **>Tree map** for organizing topics >Organize notes from lecture **>Bubble maps** for organizing and identifying key components from information >Classifying groups of items into categories on the basis of attributes.
Elaboration	Cause and effect Analogies	Applying Evaluating	>Using different media forms to generate an expanded version of concept or idea >Using **flow maps** to sequence story parts, analyze and prioritize event and identify cause and effect relationships >Judging the value or logic of ideas

Integration	Whole/part Analogies Cause and effect	Generating Integrating	>Use word processor or webpage editor to generate summaries, outlines, and analogies **>Bridge maps** for comprehending analogies, similes, and metaphors >New information and prior knowledge are connected, combined and incorporated to generate a cohesive statement with new understanding.

Sample

The sample consisted of twenty 4th grade students from a suburban elementary school. There were 19 Caucasian children and 1 African American child. None of the students were eligible for free or reduced lunch programs, thus it was expected that students came from middle to high SES environments. None of the students had been administered the AR reading test for reading material used in the study, therefore few, if any, of the children had read the books used for the treatment.

Method and Materials

Students were assigned two titles, *The Velveteen Rabbit,* and *The Lion, the Witch, and the Wardrobe.* Each child had his or her own copies purchased with funding from a university/school partnership grant. Students were introduced to the researcher and told they would read the books, then as a special project, would create original Accelerated Reader® tests for other students in the school. They were also told that they should generate thinking maps related to the content of the books. Prior to this study, the students and the classroom teacher had all received instruction in the use of thinking maps for organizing and interpreting information, and were familiar with the eight types of thinking maps as described by Hyerle (2000)

The first treatment

After each child had read *The Velveteen Rabbit,* students were administered a reading comprehension test developed by the researcher and the classroom teacher. After the tests were scored, the teacher prompted students as they brainstormed and generated phrases and key terms for the thinking maps. Inspiration®, a flowcharting software designed for elementary through high school age students, was used to display the maps on a wall screen. Hard copies of the maps were printed and returned to the students. Students were then instructed to use their thinking maps as a guide for writing the questions that could be used for the AR reading tests. These activities were spread over several days. Students were also given skills instruction in how to use the Inspiration® software and how to develop tests using the authoring program, Hyperstudio®. Many of the students were familiar with both software packages and needed less skills training than had been anticipated by researcher. After the test items had been written, students were administered a posttest. Since the *Velveteen Rabbit* was below the recommended reading level for this 4th grade class, (AR suggests grades 1-3 for this title), difference between the pre and posttest was not significant. The purpose in the first treatment was to investigate possible technical problems and to determine the computer skill level of the students. The first treatment was actually a pilot test for treatment number 2.

The second treatment

Students were given an independent reading assignment for *The Lion, the Witch, and the Wardrobe.* Each child had his or her own copy of the book and was given the freedom to read the book independently at home, or in their school classroom. After a period of two weeks, all the children had completed the book and were given a pretest created by the researcher. Items for this test were categorized by (1) Main Idea, (2) Sequence of Events, (3) Fact vs. Opinion, and (4) Cause and Effect. Items were developed to measure higher levels of comprehension and were aligned with the North Carolina Department of Public Instruction's Model for Thinking Skill Levels (NCDPI,
Available online: [http://www.ceap.wcu.edu/Houghton/Learner/Think94/NCmarzanoThink.html]). The Thinking Skills Levels model is also used to develop End of Grade (EOG) tests that determine promotion or retention for grades 4 and 8. In addition to aligning test items with Thinking Skill Levels, the test was reviewed by the classroom teacher. The researcher was confident in her ability to evaluate the test as reliable for measuring reading comprehension. There were two reasons for this; first, she had worked as a trainer in the area of student assessment, and second, she was the designated coordinator for professional development in her building. Items have been aligned with higher level thinking processes according to Marzano's Model for Dimensions of Thinking in Appendix I.

After the pre test was completed and scored, students were assigned thinking maps to analyze the content of the book. Students used bubble maps and flowcharts to present the visual images for concepts related to book characters, factors for cause and effect, and sequence of events. The maps were generated in two formats; first, the researcher developed the maps using Inspiration® as the students dictated related concepts and ideas for the maps, and second as an independent activity using paper and pencil.

After maps were completed, students were given the assignment to "write the test questions" for the AR test program. This was an independent activity in which students wrote the questions at their desk using paper and pencil. They were told that this would be their official "AR test" and could be used by others in the school to test their reading comprehension of *The Lion, the Witch, and the Wardrobe*. Students were also instructed to use information generated in the thinking maps to write their test questions. Each student wrote 5 to 7 test questions for the final "Accelerated Reader" test that would be generated using the Hyperstudio® software in the school's computer lab.

Following this, over a three-week period, students were divided into small groups and taken to the school computer lab. The researcher and the classroom teacher monitored students as they entered questions into the Hyperstudio "reading test". The test was a template prepared by the researcher and saved to disks for each student to use independently. Students were encouraged to enter as many questions as time permitted and to create elaborated versions of their test with reward buttons linked to "correct answers". Time limitations allowed only two visits to the computer lab, thus, the average number of test items completed by each student was four questions.

Following the computer lab sessions, a posttest was administered and scored by the researcher. The items in the posttest were identical to those in the pre test for measuring reading comprehension of (1) Main idea, (2) Sequence of Events, (3) Fact vs. Opinion, and (4) Cause and Effect.

Analysis of Data

The content of student questions (See Appendix II) was categorized by levels of thinking defined by NCDPI model for *Dimension for Thinking*, which is also used as a framework for test items written for EOG Tests. Each item was matched to one of the following: knowledge, organizing, analyzing, applying, evaluating, generating, or integrating. These categories represent thinking processes that would be required by the test taker as well as the test giver. It is assumed that students who generated the test item for a multiple choice test, must first write the test question, then be able to identify the correct answer as well as generate several distracter responses. Thus, students would engage in generative strategies for developing test questions, and at much higher levels than simple recall of facts.

The posttests were scored by number of correct responses. SPSS was used to calculate differences in means for pre and posttests. T test for paired samples was used to determine significant differences between the pretest and posttests generated by the researcher and posttests generated by students.

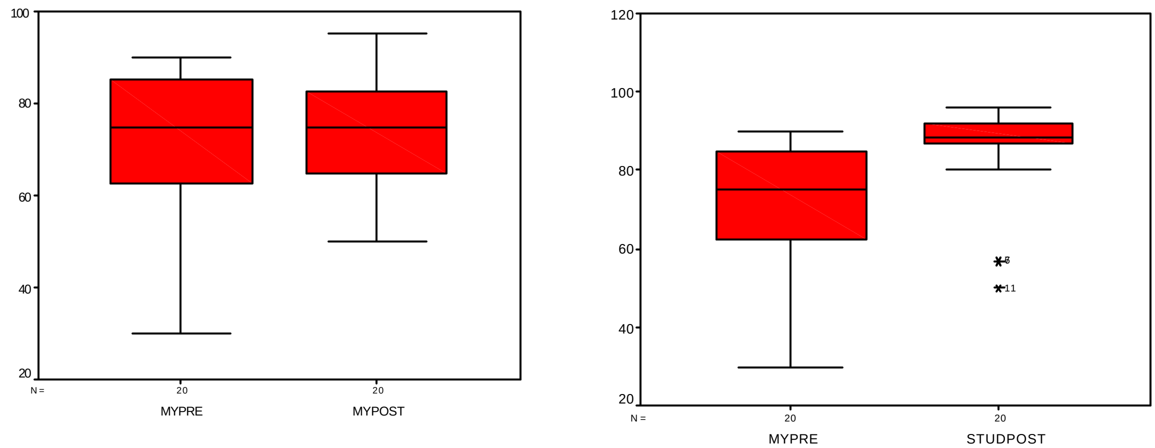
Results and Discussion

Test items developed by the researcher were aligned with the NCDPI recommendations for test development for higher levels of reading comprehension. As can be seen in Appendix II, most of the items could be categorized as organizational. Generative strategies for organization help students analyze information, see relationships, compare and contrast concepts, and restructure a large amount of information into appropriate categories. Compared to the researcher's posttest, student-generated items for the posttest contained more recall type questions but also included items for analysis, organization, application, evaluation, and integration.

Differences in pre and post test scores

There was some variation in the spread of the scores for the researcher's pre and posttest. There was very little variation in the scores for the student-generated posttest scores. As can be seen in the box charts in Figure 1, test scores on the student-generated test were tightly clustered around the mean value 85. Scores were more varied in the pre test (m = 71.5, sd = 16.7) than in the post test (m = 84.7, sd = 13.5)

Figure 1 Box charts showing spread of scores around the means for pretest and both posttests.



		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	MYPRE	71.50	20	16.70	3.73
	MYPOST	75.75	20	11.634	2.60

		Mean	N	Std. Deviation	Std. Error Mean
Pair 2	MYPRE	71.50	20	16.70	3.73
	STUDPOST	84.75	20	13.580	3.03

Since pre and posttests were administered to the same sample of students, there should be a strong positive correlation between test scores on the pre test with the scores on the researcher’s posttest as well as a strong positive correlation between the pre test and the student-generated posttest. The paired sample statistics (See Table 2) revealed a significant correlation ($p < .05$) between the pre test and post tests ($r = .76$, $df = 19$; $r =. 77$, $df = 19$).

Table 2 Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	MYPRE& MYPOST	20	.761	.000
Pair 2	MYPRE& STUDPOST	20	.773	.000

As can be seen in Table 3, the t of 1.74 for differences in the researcher’s pre and posttest was not significant at the .05 level, however, there was a significant difference in means between the pre test and the student-generated post test ($t = 5.57$, $df=19$, $p < .000$).

Table 3 Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	MYPRE - MYPOST	-4.25	10.88	2.43	-9.34	.844	-1.74	19	.097
Pair 2	MYPRE - STUDPOST	-13.25	10.62	2.37	-18.22	-8.27	**-5.57***	19	.000

Conclusions

Close to half the student-generated test items were written to measure recall of basic facts. These test items would be aligned with the students' thinking processes for recall of who, what, when, and where did this happen in the story, however, over half the students' tests questions were written at a higher level than simple recall of facts. Since students developed the items independently, this study provides strong evidence to suggest that elementary children are able to use thinking maps or other visual tools with generative writing strategies for deeper processing of textual information. From their own analyses, students were able to generate test questions that could be used to measure the higher level thinking processes of their peers. In addition, students were able to evaluate the accuracy of correct responses and determine the suitability of distracters for a reading comprehension test. It cannot be determined from this study, the full effect of the thinking maps as visual tools for interpreting and analyzing textual information. Further study is planned to investigate differences in the quality of generated test items with and without the use of the thinking maps. In addition, there should be an investigation of the effect of computerized software for generating maps when compared to simple maps produced by paper and pencil. Volk and Ritchie (1999) found significant effects from the interaction of groups with the use of generative strategies using manipulatives. Students for this study worked in a whole group session facilitated by the teacher and the researcher to generate thinking maps. Their questions, however, were generated independently using the completed thinking maps as a blueprint to construct the items. Further study in students' use of generative strategies to write test questions, with or without electronic thinking maps, may reveal similar interaction effects on their performance on the posttest.

The bubble format was the thinking map of choice for the students. Hyerle (2000) defines the bubble map as an analytic tool. This type of thinking and mental processing should help the student to develop a deeper conceptual understanding of a reading passage. For example, students used the bubble map to analyze the personalities of all the characters in *The Lion, the Witch, and the Wardrobe.* Each character's personal traits were defined, discussed, and then identified as villain, hero, good, evil, protagonist, etc. For some of the maps, students developed a flowchart to analyze the sequence of events. During the whole class sessions, students carefully analyzed the order of events for the story. From this kind of mental processing, it would be expected that students would write more test items for organizing and analyzing ideas. It is surprising, then, to discover that the students' test items were in the categories for *applying, evaluating* and *integrating* ideas. For example, one student wrote, "9. Why did Mr. Tumnus get made into stone?". Since the story did not clearly explain the full reason, the reader would need to make certain assumptions based on the character's actions in relation to the villain's personality traits. In addition, the reader would need to evaluate certain moral justifications that were not explicitly stated in the story. This would, more likely, require thinking processes for integration of new information with prior experiences and synthesis of ideas than organization and sequence of events.

Writing test questions with accurate answers and appropriate distracters would also help students evaluate the concepts and events in the story. Since the test items were generated independently, it may have resulted in students' greater use of generative strategies for integration of new ideas with prior knowledge and across the various ideas rather than organization of events. Integration strategies increase students' ability to see relationships and connections between ideas and concepts. This type of mental processing would certainly result in students' ability to develop questions for application of concepts and synthesis of themes and ideas across the entire book. In answer to the first question in this study, a qualitative evaluation of students' test questions would suggest elementary age children can generate test items consistent with higher level thinking processes.

A paired sample t test was used to measure the differences in means between the pretest and posttest developed by the researcher. It was hoped that the use of the generative strategies would have a more significant effect on students' test scores, however, differences were marginal at the .05 level ($t = 1.74$, $df = 19$, $p < .09$). In retrospect, I would set the significance level at .10 for two reasons. First, this study was not in a controlled laboratory setting nor were students tested for reading ability and cognitive capacity prior to the treatment. Similar to the study by Volk and Ritchie (1999), this was a pilot study with many variables that might interfere with the results of students' performance. Second, scores from matched pairs are less likely to reveal differences based on the effect of the treatment. According to Popham and Sirotnik (1992), with corresponding scores, there is a tendency, that differences in means are less likely to be significantly different.

There was a significant difference between the means from the pre test and means from the student-generated post test ($t = 5.57$, $df = 19$, $p < .000$). Using paper and pencil, each student had written 4 to 5 items, and then entered these into the Hyperstudio® stack for the mock AR test. From this pool of test questions, 20 items were selected. These were copied and pasted into a word-processed document and administered to the students as a paper and pencil test. Conditions for the student-generated posttest were identical to those of the researcher's posttest. T test statistics for paired samples showed a significant correlation between the data from the pre test and the data from the posttests. Students who performed poorly on the pre test, performed at a corresponding level on both posttests, thus it is likely that the student-generated posttest was reliable. In answer to question 2, this would suggest that the use of organizational strategies for generating original reading comprehension questions does have a positive effect for student performance. Further, the effect of the treatment appears to improve scores for a criterion referenced test for main idea, sequence of events, fact versus opinion, and cause/effect factors. There should be further study to provide evidence to support the effectiveness for the use of generative test questions. This could be accomplished by measuring gains in scores for this sample with a comparable group who did not receive the treatment. The answer to question 3 is answered by comparing the means between both posttests. Descriptive statistics show that students did perform better when answering their peers' questions than the items from the researcher's test (see Table 3). At first, this may appear of little interest, but with the qualitative evaluation of students' test items for higher thinking processes, their performance on this test may reveal some positive effects from the treatment.

Students were also highly motivated to develop a test that would be taken by their peers. This was an authentic problem in which students were challenged to write a mock test for Accelerated Reader. Since research has shown that students are motivated to solve a real-world problem, I was able to observe students as they exhibited an effort to construct questions which they judged as fair and would be important for measuring reading comprehension. Because of the earlier experiences with AR testing, students were familiar with the multiple-choice format. Based on this experience, they were also able to make some judgments in what kinds of questions measure reading ability.

The pool of questions written by the students was characteristic of high level of thinking processes for seeing relationships among ideas presented in the story. Students also demonstrated a high level of evaluative skill for constructing test questions that are suitable for measuring reading comprehension. Although student performance showed marginal performance on the criterion-referenced posttest, students showed significant improvement when answering test questions developed by their peers. This study clearly provides support for the use of generative strategies for higher level thinking when reading and interpreting textual information.

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Appendix I	Pretest developed using framework from Dimensions for Thinking. Available online: [http://www.ceap.wcu.edu/Houghton/Learner/Think94/NCmarzanoThink.html]
NCDPI adapted from Marzano's Dimensions for Thinking	**Pre and Post Test Questions** Generated by Researcher
Knowledge Declarative and procedural knowledge	**Recall** 11. Who did Lucy meet first? 13. What do the children do after Aslan comes back to life?
Organizing Comparing, classifying, and ordering sequences Analyzing Identifying attributes and components; Identifying relationships and patterns	**Sequence** 9. What happened first? a. Peter discovered….. b. Lucy found…. c. Edmund found… d. Edmund and Lucy found…. 10. Aslan was victorious …. a. after Edmund… b. after Aslan was… c. after Peter was…. d. after all the animals…. 12. Who were the last two people to see Aslan alive? **Cause and Effect** 14. Edmund loved the idea of becoming a Prince because….. 15. The Professor told Susan and Peter that Lucy might be telling the truth because…. 16. The Battle between Aslan and the Witch would have been lost except….. 8. Lucy was very worried about Mr. Tumnus because….. **Main Idea** 1. Which of the following best describes Aslan? 2. Which of the following best describes the Witch? 3. Which of the following best describes Edmond?
Applying Demonstration of prior knowledge within a new situation Evaluating Confirming or proving the truth of an idea,	**Main Idea** 4. At the beginning of the story, Edmund pretended that he had not really found Narnia and was making the story up because…? 7. After Edmund had been rescued by Aslan he felt….. **Fact versus Opinion** 17. The Witch was wicked and lonely 18. Aslan was good and brave 19. In the end, Edmund was a hero 20. Turkish Delight is delicious
Generating Inferring, Predicting & Elaborating Integrating Summarizing and restructuring; identifying important components to generate a cohesive thought.	**Main Idea** 5. Why did Edmund have to die at the hand of the Witch? 6. Why did Aslan die? 7. After Edmund had been rescued by Aslan he felt…..

Appendix II	Comparison of researcher-test with student-test for match with higher levels of thinking.	Note: certain test items may match more than one category.		
NCDPI adapted from Marzano's Dimensions for Thinking	**Post Test Questions Generated by 4th Grade Students**	**Dimensions for Thinking category**	**Number of items from researcher's test that match category (see Table 2)**	**Number of items from students' test that match category**
Knowledge	1. How did Lucy discover Narnia? 2. Who was Aslan? 5. The White Witch told Edmund he would become a _______when she was gone…. 10. What did Father Christmas give Peter? 16. What game were the kids playing when they found the wardrobe? 18. Where did the Professor live? 19. What food did Mr. Tumnus NOT give Lucy in his home? 21. How many reindeer did the White Witch have on her sled?	Knowledge	2	8
Organizing Analyzing	3. When Lucy and Susan followed Aslan, they followed him to….. 6. The first kid who knew about Narnia was…. a. the youngest in the family b. the last to know about Narnia c. the meanest kid in the family d. the oldest kid in the family 8. When Lucy went to Narnia, who did she first meet? 15. Did Edmund get to eat his favorite food when he got to the Witch's house?	Organizing Analyzing	19	4
Applying Evaluating	7. Why did Aslan die? 9. Why did Mr. Tumnus get made into stone? 11. Why did Mr. Tumnus ask Lucy if she was a daughter of Eve? 12. Why does Edmund leave the Beaver's house? 13. What does Edmund want from the White Witch? 26. Why did the Beavers say, "Be quiet!"?	Applying Evaluating	6	6
• Generating • Integrating	14. Why didn't Edmund tell the others he had found Narnia just like Lucy did? 17. How was Aslan brought back to life?	Generating Integrating	3	2

The Technology Teaching Lab: Meeting the ISTE Standards

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Abstract

The technology teaching lab program is a series of 2-hour labs that runs concurrently with preservice methods blocks. The purpose of the lab is to give the students the experiences necessary to integrate technology into their classroom. The lab provides the students with instruction, opportunities, and equipment to take their technology-enhanced lessons directly to the field.

This research found that given time, technology, assistance, and experience, students could create technology-enhanced lessons. The implementation of the technology teaching lab, connected with the profile template, provides preservice teachers with the structure and opportunities to meet the profile goals set by ISTE. Finally, the technology teaching lab and the accompanying template provides for opportunity for reflection and demonstration of best works, similar to a portfolio. The benefits from this program are visible, follow from the collected data, and provide for opportunities to infuse technology into the preservice teacher education program and expectations.

Problem

According to the U.S. Department of Education, only 20% of the 2.5 million teachers currently working in our public schools feel comfortable using the technologies available to them (NCES, 1999). This is a tragedy, but one that is remedied by providing students with a true working knowledge of current educational technologies and opportunities and experiences to integrate those technologies into their classrooms. Many colleges of education have found ways to increase students' knowledge of technology through independent courses. It is reported by the Office of Technology Assessment (1995) that much of technology instruction is related to the teaching of technology instead of teaching with technology to enrich curriculum (Duhaney, 2001). Nevertheless, institutions should teach teachers how to use technology to support multiple content curriculums (Ingram, 1994). Unfortunately, there has been little done in the area of experiences of technologies in the classrooms. Because of the importance of experiences with technology in the field, it is the goal of many departments of education to include clinical experiences (Duffield, 1997).

Currently, the education department at Ohio State University at Mansfield is trying to incorporate technology into our courses by giving assignments that encourage the use of technology. Unfortunately, there is no time given to students to experiment or develop the technology-enhanced lessons. The methods courses are full of methods content. Nevertheless, it is vital to give students experiences both in teaching with technology and participating as a student using technology (Cuba, 1995). Because of this, our department makes every attempt to enhance our teaching with technology. This happens through required presentations, including the input of digital images, expectations of technology for required lesson development and assessments, the use of digital picture displays to enhance an activity, and the use of Web CT. Through the development of these and other uses of technology in our methods courses, we are beginning to give our students experiences from a student perspective. In addition to this, though, there must be a teaching component to technology experiences. This happens with the development of the technology teaching lab.

Research Questions

This is a qualitative ethnographic study in case format as defined by Guba and Lincoln (1994). It is because of this methodology that issues of description and interpretation are of utmost concern. The questions informing the interpretation of data in this study have the following foci:

- Determine whether a student can or cannot reach the expectations of the ISTE Profile Standards for Professional Performance through the implementation of the technology teaching lab.
- Determine types of technology infusion used to meet these standards.
- Determine the perceived ability of the students following the technology teaching lab.

The Technology Teaching Lab

Before the Technology Teaching Lab, if a student wished to use technology in her field placement Ohio State University at Mansfield, not only did she have to plan, create, and write the lesson in her own time in addition to the other lessons from the content areas, but she had to depend on the technologies of the school in which she is placed. Often times, the schools would have little equipment or equipment that is not compatible with the developed lesson.

The Lab Course

The goal for this program is to increase the use of technology in our students' lessons in ways that will enhance their teaching. The purpose of this lab is to provide the preservice teachers in our elementary education program opportunities and assistance in creating and using technology-enhanced lessons into their field placements. The Technology Teaching Lab component is a 2-credit course scheduled for two quarters to run simultaneously with our methods blocks. Connections and constructivist theory are two foundations to our program. Any new addition to our program needed to address both core areas. Because of our strong commitment to the integrated approach to teaching, our technology component needed to connect to our methods blocks. Our methods blocks run in two consecutive quarters to include a methods course from social studies, math, language arts, and science. We addressed the issue of connection by including requirements for technology-enhanced lessons in each of our syllabi. Within each content area, there are expectations for lesson development and integration within those lessons. We expect our students to write their lessons in a unit: integrating content as much as possible, when there is a natural fit. By connecting the technology teaching lab with the content methods courses, we provide our students with multiple ways to integrate technology into each content area and thus integrate the content areas through technology. Each methods course has an expectation of technology integration into the lessons.

The lab course meets once every week during the same quarters as our methods block for a two-hour period. There are two time slots available to better meet the needs of the students: one after school on class days and one after school on their field placement days. In addition, the lab space is available for walk-ins throughout the week. The students work during this time to create technology-enhanced lessons that they will take directly to their field placement. There is little direct instruction; instead, time is spent on the uses of instructional technologies, demonstrations of those uses, and play with the equipment. The primary structure of the lab course is open and one of discovery and experience. Students are to play and create lessons, again, to take directly to the field.

Students write technology-enhanced lessons and use educational technology in their field placements. This important facet (that of experience) of the lab course gives students the practice in developing and revising educationally sound, technology-enhanced lessons for their future classrooms. The lab provides students supervised time to experiment with the hardware and software to create technology-enhanced lessons that connect to the requirements of the methods courses. These technology-enhanced lessons incorporate imaging, Internet use, and presentation tools. Then, the students take the created lessons directly to the field.

The Lab Instructor

We addressed our other area of focus, constructivist-learning philosophies, through the format of the lab course. The natural starting point for instruction in a constructivist classroom is not the material to be taught, but student interests, prior experiences, and current understandings (Ravitz, Becker, & Wong, 2000). Because of this, a true constructivist form of a Technology Teaching Lab would have to accommodate for a variety of levels of technology abilities in the students and provide for their varying interests. We designed the Technology Teaching Lab course to be one of discovery and experience. The purpose of the lab is to provide our students with the opportunities to develop appropriate uses of the technologies in their field placements and to then take those lessons directly to the field, giving the students the experiences necessary to integrate technology into their classroom.

The teacher's role in a constructivist setting is to facilitate student-designed efforts. This instructor is also available in the physical space of the lab to assist students. The major focus of the instructor's time is on play and on emergent needs of particular lesson creations. The instructor's responsibility is to help the students develop educationally sound applications of technology in their field placement in close connection to the education department and the needs and requirements of the methods courses. The instructor is also available in the physical space of the lab to assist students.

Equipment

We purchased a variety of technology tools that tour students could take directly to their field placements. These tools included: portable laptop and projector sets, flex cams, digital microscopes, computer calculator sets, a variety of canned software, digital cameras, and digital video cameras. By providing the students with the equipment, the students can create a lesson and deliver the lesson directly without concern for lack of hardware, software, or hardware mismatches.

The Assessment tool

As a department, we have adopted the ISTE standards (International Society for Technology in Education, 2000) for technology in preservice education. As an evaluation piece, I created a template out of those competencies specifically set to the professional preparation performance profile created for pre-service teachers to be completed before their internship experience (ISTE, 2000). Each of our students downloaded this template, the profile in table form, onto a zip disc. Our students wrote a short narrative addressing how they hit each of the competencies and included with this narrative a hyperlink to electronic evidence of their work. This evidence could be in a variety of forms. For example, if a student wanted to demonstrate that she wrote and taught a lesson using Hyper Studio, she might use two forms of evidence. First, she might hyperlink the lesson portion to her actual text document write-up of the lesson. Second, she might hyperlink her teaching evidence to an example of a student's presentation. In doing this, the student has demonstrated her capabilities to write and teach a technologically enhanced lesson, and demonstrated her ability to use technology as a form of self-evaluation. She is documenting her technology use and at a future time, can reflect on that use and revise and recreate. Another example might be that of email threaded discussions maintained throughout a field assignment. The student teacher could simply retain a copy of the discussions and hyperlink them to the template to use as electronic documentation. A sample portion of template is provided in table 1.

Table 1. Template Sample

Prior to the culminating student teaching or internship experience		
Technology Operations and Concepts		
	Task	**Electronic Evidence**
Examine technology tools used to collect, analyze, interpret, represent, and communicate student performance data.	"Free online grade book software."	http://www.classbuilder.com
Planning and Designing Learning Environments and Experiences		
Identify technology resources available in schools and analyze how accessibility to those resources affects planning for instruction.	"Taught an integrated lesson which included an Excel graphing exercise in the computer lab. Twenty-three students in class."	bellvillelesson17.doc
Design and teach technology-enriched learning activities that connect content standards with student technology standards and meet the divers needs of students.	"An example of a student-produced graph from an integrated technology lesson I taught in the computer lab at Bellville Elementary."	**Cody.xls**
Teaching, Learning, and the Curriculum		
Apply on-line and other technology resources to support problem solving and related decision making for maximum student learning.	"Incorporate higher-level thinking problems and questions with NCTM math-related activities."	http://standards.nctm.org/document/eexamples/index.htm
Productivity and Professional Practice		
Identify and engage in technology-based opportunities for professional education and lifelong learning, including the use of distance learning.	"Opportunities for professional development and resources."	http://www.nctm.org http://www.ohioschoolnet.k12.oh.us/
Social, Ethical, Legal, and Human Issues		
Identify issues related to equitable access to technology in school, community, and home environments.	"Equity project WI '01"	**EquityWI01.ppt**

Methodology

Purpose of Study

The purpose of this study is multifaceted: first, to determine whether or not students can meet the expectations of the professional preparation standards set by the ISTE standards can be met by the implementation of the technology teaching lab and second, to determine what level of technology infusion students choose to use in meeting these standards and finally to guide development of the technology teaching lab. The results of this study will be beneficial to other departments of education in their drive to meet national standards and infuse technology into their programs.

Design, Instrumentation, and Data Analysis

The design of this study utilized qualitative research methods from the interpretivist paradigm (Guba & Lincoln, 1994). This is a case-study to represent a molar unit, a multiple of individuals (preservice teachers). The use of a molar unit in this case is to extend external validity of results (Huberman & Miles, 1994). The case format is not one of generlizability; it instead has a focus of transferability. This transfer is to similar sets of participants. Data were gathered from multiple sources during the 2000-2001 school year.

The data was collected in two formats. First, the ISTE profile template (as defined previously as the tool for the course). The data from the template was inserted into a database for ease of analysis. The database was analyzed in a variety of manners. First, the database was used to determine what the students used as an electronic example for their meeting a particular standard. Second, the variety of evidence used to document to student's meeting the standards. Finally, the database was used to interpret the level of technology infusion.

In addition to the database, a survey was distributed at the end of the second quarter in which the students took the lab. This survey asked questions about the student's perceptions of their technology abilities, their anticipated use of technology in the classroom, and their impressions of the technology teaching lab. Open-ended comments listing strengths and concerns were coded by emergent topics. A cluster method of data analysis was used throughout the interpretation of data (Huberman & Miles, 1994).

Description of site and participants

This study took place at a regional campus of a large, mid-west University. The participants for this study were 21 Masters of Education students. Their ages ranged from 23-43, four male; 17 female, 20 Caucasian; 1 Asian-American, and from middle-class background. Students came to the masters degree certification program with a variety of undergraduate degrees: elementary education, psychology, law, the ministry, and private business. All students were required to take the 2-credit hour technology teaching lab course with each of their methods block quarters (totaling 4 credit hours). This was the first year of this requirement.

Results

Demonstration of Technology Use

At the end of the second lab course, students completed their templates with a narrative stating how they met each standard and a hyperlink connecting to a piece of electronic evidence that supported their statement. Table 2 shows the distribution of electronic evidence used by the students in their templates. The data is heavy in the areas of web sites and presentations. The use of web sites was intriguing and warranted further investigation into the manner by which they used the sites as documentation of meeting a particular standard. The manner in which the sites were used in denoted in the second category of results, level of evidence. The use of presentations as a demonstration of evidence stems from the assignments given in the methods block courses. In the 2002-2001 school year, the year of this study, the students were required to produce a presentation in the math and science methods block courses in which they took digital video of an integrated lesson, imported portions of their video into a power point presentation, and reflected upon the concerns and strengths of the lesson. This project was called the MST project and each student created two presentations in this format; one in the first methods block and another in the second methods block.

Table 2. Evidence Used

	Web Sites	**Documents**	**Excel**	**Presentations**	**Other**
Technology Operations and Concepts	19	1	1	1	18
Planning and Designing Learning Environments and Experiences	40	22	2	71	3
Teaching, Learning, and the Curriculum	48	11		1	
Assessment and Evaluation	48			20	10
Productivity and Professional Practice	20	4	2	14	
Social, Ethical, Legal, and Human Issues	92			2	2
Total	**267**	**38**	**5**	**109**	**33**
Percentage of profile standards met	**59%**	**9%**	**1%**	**24%**	**7%**

Level of Technology Evidence

In addition to the types of technology used by the students as evidence of meeting the profile, the data was analyzed for level of technology integration. In this analysis, a clustering and coding method was implemented. This coding produced three major categories of technology infusing: teacher-centered technology, child-centered technology, and task-centered technology. Teacher-centered technology refers to technology used by the teacher but in the context of a lesson. In this case, the teacher is the worker. It would be similar to the teacher using technology to enhance a lesson that would otherwise be teacher directed. An example of teacher-centered technology would be a teacher-created presentation using power point or Hyperstudio to demonstrate the development of a seed. Another example of teacher-center technology would be a class-created excel chart in which the teacher input the data on a centered machine that is connected to a projector or large screen television. Another example of a teacher-center use would be the teacher using some sort of project device to demonstrate the components of a seed using a flex cam. Still another example of a teacher-center infusion would be a class game using a canned CD and a projection device.

The second category for technology infusion determined by analyzing the data from the templates is child-centered technology. This format refers to technology used by the children in the class, either in small groups or individually. In this case, the child is the worker. This would be similar to the teacher using technology to enhance a small group task or individual seat work assignment. An example of child-centered technology would be child creating a publishing document that focused on a particular country to be used as an assessment in a class. Another example of this format would be a group of students creating a presentation documenting the recycling of garbage. Another form of child-centered technology would be a student writing a story and importing still photos to illustrate the story. Still another form of child-centered technology would be the use of Internet interactive tools with each child at a computer station (ex. E-examples from NCTM).

The third category for technology infusion determined by the template is task-center technology. This format refers to technology used by the teacher in the design of a lesson, a class, or profession growth or organization. In this case, the task is the focus with the teacher as the worker. This would be aligned to traditional preparation and paperwork connected to the profession of teaching. An example of task-centered technology would be a web site used to obtain information about a lesson on the circulatory system. Another example would be the creation of an excel chart or word "chat" or email format that demonstrated collaboration on issues of teaching. Still another example would the completion of an assignment for a course in education (in document, sheet, or presentation format).

Table 3 indicates the various forms of technology evidence used by the preservice teachers to demonstrate competence in the performance indicators. Special note is made to the performance indicator goal, which in many cases does not require lesson development, but rather technology use in the profession of teaching.

Table 3. Narrative Coding

	Teacher-center technology	**Child-centered technology**	**Task-centered technology**
Technology Operations and Concepts	0	0	54 (100%)
Planning and Designing Learning Environments and Experiences	12 (7%)	67 (38%)	96 (55%)
Teaching, Learning, and the Curriculum	0	4 (6%)	60 (94%)
Assessment and Evaluation	1 (1%)	12 (12%)	87 (87%)
Productivity and Professional Practice	0	0	43 (100%)
Social, Ethical, Legal, and Human Issues	0	0	104 (100%)
Total	**13**	**83**	**444**
Percentage of profile	**3%**	**15%**	**82%**

Student Perceptions

Secondary to the template, was the survey. This survey was administered for the purposes of course development. Nevertheless, the survey indicates a level of ability and comfort that could inform other institutions where technology infusion programs are being developed and under consideration. Table 4 indicates the technologies that student would most likely use in their teaching. This reflects technologies that were emphasized during the technology teaching lab and those technologies that were demonstrated during the technology teaching lab.

Table 4. Technology most-likely to use in teaching

Hardware	Raw score*	**Rank**	Raw score*	Software
Digital camera	26	**1**	22	Word processing
Flatbed scanner	57	**2**	43	Internet
Digital video camera	64	**3**	75	Power point
Flex cam	71	**4**	83	Hyperstudio
Multimedia projector	94	**5**	93	Educational programs
Dissecting microscope	100	**6**	104	Spreadsheet
Digital balance	113	**7**	111	Database

* Combined rating of 20 students with a rating of 1 as most likely.

Student Perceptions of Technology Teaching Lab

An open-ended comment section of the survey revealed what the students thought were concerns and strengths of the technology teaching lab. These concerns could be categorized into three subheadings: Instructor, time, technology, and ability. Interestingly, the instructor and ability were indicated and coded as major categories for both the concerns and the strengths of the technology teaching lab. The instructor was commended on several surveys for being available, experienced, and flexible. An example of this was, "Instructor was flexible, helpful, patient, personable, kept the class 'real'". Alternatively, the instructor was also listed as a concern for a lack of expertness, and not conducting the class on an individual level. Ability was an indicator of strength; "Class is needed, gained an enormous amount, a lot further in my ability to use technology, I learned a lot, I feel capable," and a concern; "…overkill, quite comfortable previous to this class, lab times inconvenient, class needs to be 'stepped up', should have been much more help, start classes in fall, need better connection to methods courses."

One of the categories that did not show through in both strengths and concerns was that of time. Time was indicated as a strength because students felt that they were given an extended period of time to actually write technology-enhanced lessons; "...lots of time to work on our technology components of projects, more time to use technology to plan lessons." Technology was listed as a concern, as it often is in the cases of infusing technology into the classroom; "…technology fail (ures), better connection to printer, (need) better equipment"

Discussion

The technology teaching lab, while still in its infancy, shows great promise. It provided a venue for preservice teachers to address issues of technology connected to their field placements and to their classroom assignments. It demonstrated a connection to the questions stated earlier in this writing.

The Technology Teaching Lab and the ISTE Standards

It follows that students can meet the profile set by ISTE Profile Standards for Professional Performance through the implementation of the technology teaching lab and courses similar in focus. The students used a variety of electronic evidence but the primary tool was that of web sites. At first glance, this might be disturbing. However, this indicates that students find the tool of the computer useful in the research and information gathering aspect of teaching and learning. When reading the data, it was necessary to realize that the ISTE profile contains six categories: Technology Operations and Concepts, Planning and Designing Learning Environments, Teaching, Learning, and the Curriculum, Assessment and Evaluation, Productivity and Professional Practice, and Social, Ethical, Legal, and Human Issues. The majority of the six categories focus on technology issues and not technology as a tool of instruction. Under the heading of Planning and Designing Learning Environments, Teaching, Learning, and the Curriculum, and Assessment and Evaluation, it would be reasonable to find students using a variety of electronic evidence indicators. It may be advantageous for instructors to suggest types of evidence that would meet particular goals, but I hesitate to say this in light of the focus of constructive methods for the class. By suggesting a specific piece of evidence, it may limit the preservice teacher's creative role in this venture. Still, a wider variety of evidential components would be preferable.

Technology Infusion: Types and Level

By categorizing the evidential narratives given by the students, it was clear that there are three major roles of technology in preservice teacher education: teach-center technology, child-centered technology, and task-center technology. Again, looking at the profile stated, the issues that students needed to address were various. Many students met professional profile expectations using appropriate manners. The students who used child-center technology used it under headings were that was appropriate: Planning and Designing Learning Environments and Experiences and Assessment and Evaluation. Again, at first glance, one might wish to see more teacher-centered and child-center technologies indicated in the narrative section of the template. However, the fact that the students used a variety of teacher, child, and task centered activities is encouraging. It is vital to use a variety of methods of technology infusion into teaching. Just as it is vital to use a variety of teaching methods in teaching. The fact that the preservice teachers used many task-centered narratives indicates the place they are in their program (using technology to complete assignment tasks) and their developmental stage in teaching (initial play and discovery).

Student Perceptions

It is reasonable for the students to wish to use technologies in their teaching that they have familiarity with and that they have had success with in the past. This is clear in their indication that word processing, digital cameras, and presentations would be of interest to them in their teaching. The students in this program were expected to use these technologies throughout the methods blocks and chose to use them in their field placements. They are very familiar with presentation software through class assignment in their methods blocks. It is a goal to get them to feel more comfortable with the uses of other technologies: flex cams, computer calculators, digital imaging, and projection devises. This will happen through the emphasis of these technologies in their methods blocks to give them the student perspective. This experience then will give students a feeling of comfort and success that they can then transfer to their teaching. It is also vital for preservice teachers to see how professors use technology to enhance their teaching. Through this, the process of teaching with technology is modeled and can then be applied to their teaching.

Modifications for the Technology Teaching Lab

There are a few considerations to make to modify the technology teaching lab to better meet the needs of students and the expectations of the ISTE standards. One issue that arose through the data was that of instructor. While the original intend of the technology teaching lab was to create a block of time where students could play and invent, the instructor relied on a more instruction-based format. This created problems for students who felt that they did not need the instructional time on particular technologies and for the students whom desperately need the "play" time to accommodate their learning style. The instructor has since modified his instructional method to better meet the constructivist, discovery format and preliminary lesson submissions from the current cohort of students shows an increase in technology infused lessons. This demonstrates a need for a particular teacher and learner paradigm distinction to best accommodate the technology teaching lab and its intent to foster technology-infused lesson development in preservice teachers' lessons.

Another aspect of modification is that of classroom experience. Our students are benefiting from an increased role of technology in their methods block course. This increase gives the students opportunities to see technology used in instruction from a students' perspective. Some of the additional and continuing aspects of technology infusing in the methods courses include: Computer Poster Sessions, Computer Calculators, Flex Cam and GPS demonstrations, electronic backyard History Projects, Integrated Assignments including the MST Projects (Math/Science), Equity Project (Math/Social Studies), and Drama Display (Math/Language Arts).

Finally, the modification connected to the particular technologies used in the methods blocks and in the technology teaching lab need to be consistently revisited. Technologies available to teachers in the schools are ever-changing and need continual modifications.

Consideration for future research

Currently, students in the preservice program are required to take an inventory of abilities and experiences connected with the ISTE profile. Students take a 2-part survey in which they self-report experiences with technologies and ability with technologies connected to the profile subsections: Technology Operations and Concepts, Planning and Designing Learning Environments, Teaching, Learning, and the Curriculum, Assessment and Evaluation, Productivity and Professional Practice, and Social, Ethical, Legal, and Human Issues. This survey will demonstrate growth incurred by the implementation of the technology teaching lab. Additional data is also being collected for future research connected with the students' lesson plans. Future research will not only use data from the template and the survey, but also coding from the submitted lessons and lesson reflections that include technology as a component.

It would be a benefit to this research and to research on technology in teacher education in general if follow-up studies were conducted to connect preservice teachers' indications of use with actual use, observed and reported after the teachers are employed full-time. Such research would add to the field of technology infusion in teacher education.

Conclusion

In conclusion, this report finds that given time, technology, assistance, and experience, students can and will create technology-enhanced lessons. These experiences of creating and field-testing lessons with the assistance of technology or with the inclusion of technology will aid students in the task of meeting the ISTE professional preparation performance profile. The technology teaching lab is one option for providing such qualities to a preservice education program. In addition, the template used throughout this program is a valuable tool for departments to use when evaluating program and providing evidence for current and future grants. Finally, the technology teaching lab and the accompanying template provides for opportunity for reflection and demonstration of best works, similar to a portfolio. The benefits from this program are visible, follow from the collected data, and provide for opportunities to infuse technology into the preservice teacher education program and expectations.

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Effects of Embedded Relevance Enhancement in CBIM Program for English as a Foreign Language Learners

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Abstract

This 2 X 2 factorial experimental study is to investigate effects of intrinsic motivation and embedded instructional strategies designed to enhance relevance on students' perceptions of motivation and understanding of the instructional material within a computer-based interactive multimedia lesson for college English as a foreign language students. The findings indicated that highly intrinsically motivated students learned more and the use of embedded relevance strategies facilitates students' language learning regardless of learners' level of intrinsic motivation.

Introduction

Traditionally, schools rely heavily on extrinsically motivated behavior (Brown, 1994). For example, standardized tests, exams which have given high authority, are often used to drive student performance. In most countries that teach English as a foreign language, school-level instruction does not emphasize the function of English as a tool for communication but instead focuses on how to pass the tests. The consequence of this is that students work hard to try to pass the exam to please teachers and parents rather than develop an internal thirst for knowledge and experience. It is not a surprise that students often lose their interest in English learning as a result. EFL teachers should provide students with authentic, functional, interactive, and constructive language learning environments to reduce students' anxiety, raise students' motivation, and increase students' confidence. The use of relevance-enhancing strategies in a CBIM language-learning environment offers promise. This study investigated the effects of intrinsic motivation and embedded instructional strategies designed to enhance relevance on students' perceptions of motivation as well as students' understanding of the instructional material within a computer-based interactive multimedia (CBIM) lesson for college English as a foreign language students.

Background

In recent times, a major trend in pedagogy related to second language learning has arisen from the realization that knowledge of grammatical forms and structures alone does not adequately prepare learners for effective and appropriate use of the language they are learning. Researchers have claimed that there should be a shift in emphasis from the structure and form of language to communicative meaning. They have argued pointedly that the ultimate goal for language learning and teaching is to help learners develop communicative competence (Berns, 1990; Savignon, 1997). Hence, communicative language teaching (CLT) researchers have identified new pedagogical orientations and suggested that communicative approaches are needed in language teaching and learning (Angelis & Henderson, 1989; Berns, 1990; Savignon, 1983, 1997; Underwood, 1984). In order to help accomplish the ultimate goal of communicative language teaching, Brown (1993) suggested the utilization of technology such as films, videos, and computers.

Keller (1983, 1987) claimed that strategies embedded in instructional materials can enhance the learner's attention to the materials and perceptions of relevance, confidence and satisfaction about learning, which in turn can enhance cognitive performance. Keller and Kopp (1987) argued that embedding relevance strategies can improve motivation and performance and should be used to connect the learning to the learner. Nwagbara (1993) reported positive findings about building a relevance component in instructional material to improve learners' motivation.

CBIM (computer-based interactive multimedia) is an instructional approach that can create a language learning environment that embraces constructivism and interaction (Milheim, 1995) through its multiple roles and unique properties. SLA (second language acquisition) researchers have indicated that the audio-visual and textual resources found within computer applications can aid in building activities to help students develop the various competencies mobilized in communication (Chanier, 1996; Murray, Morgenstern, & Furstenberg, 1991). There is no doubt that CBIM has a promising future for foreign language teaching and learning. However, technology itself cannot help instruction without careful instructional design. Using the unique features of CBIM, integration of appropriate instructional strategies can foster student learning and help learners learn how to learn (Reigeluth, 1983; Wenden, 1985).

This study was conducted to investigate the effect of embedding relevance-enhancing strategies in foreign language classes. The relationship between learners' motivation and embedded relevance strategies was also examined.

Methods

The 2 X 2 factorial experimental posttest-only design was employed with two categorical independent variables, level of intrinsic motivation (higher or lower) and embedded relevance enhancement (with or without), and two continuous dependent variables, achievement and motivation perception. The Intrinsic Motivation Orientation Scale (IMOS), a scale developed by the researcher (Cronbach coefficient alpha was .93), measured the first independent variable, learners' level of intrinsic motivation. Totally 313 subjects were categorized as having a higher or lower level of intrinsic motivation based on their score on the IMOS. The second independent variable, embedded enhanced relevance strategies, was the treatment; strategies were based on the Relevance Concept and Tactics Checklist developed by Keller (1990). Within each intrinsic motivation group, learners were randomly assigned to a treatment consisting of a computer-based instructional multimedia program featuring English language text, videos, and exercises on the topic of criticism either with or without enhanced relevance components. The dependent variables, operationally defines as the score on a comprehension test and the score on the Modified Instructional Material Motivation Survey (MIMMS), were measured after students completed the computer-based interactive multimedia (CBIM) program. Two-way analysis of variance (ANOVA) was used to analyze the data collected.

Data Analysis and Results

The comprehension test means for each of the four treatment groups are shown in Table 1. When comparing scores by Level of Intrinsic Motivation, one can see the Higher Level of Intrinsic Motivation group mean of 11.97 was higher than the Lower Level of Intrinsic Motivation group mean of 10.47. The Higher Level of Intrinsic Motivation group obtained a higher score than the Lower Level of Intrinsic Motivation group in both the control and experimental condition. When comparing means by treatments, the experimental group mean of 12.75 was higher than the control group mean of 9.63. In spite of different levels of intrinsic motivation, subjects who received embedded relevance enhancement obtained higher scores on the comprehension test than subjects who did not receive embedded relevance enhancement.

Table 1 Comprehension Test Means (SDs) for All Four Groups

		Level of Intrinsic Motivation		
Treatments		*Higher*	*Lower*	*Combined*
Enhanced Relevance	*With (experimental)*	*n = 79* *M = 13.51(4.88)*	*n = 80* *M = 11.99(4.49)*	*n = 159* *M = 12.75(4.73)*
	Without (control)	*n = 76* *M = 10.36(3.79)*	*n = 78* *M = 8.92(3.09)*	*n = 154* *M = 9.63(3.52)*
	Combined	*n = 155* *M = 11.97(4.64)*	*n = 158* *M = 10.47(4.14)*	

The results of the MIMMS for each of the four groups are shown in Table 2. The Higher Level of Intrinsic Motivation group mean of 125.63 was greater than the Lower Level of Intrinsic Motivation group mean of 113.85. The mean for the Embedded Relevance Enhancement group of 123.10 was greater than the mean for the control group of 116.21.

Table 2 The MIMMS Means (SDs) for All Four Groups

		Level of Intrinsic Motivation		
Treatments		*Higher*	*Lower*	*Combined*
Enhanced Relevance	*With (experimental)*	*n = 79* *M = 130.62(15.19)*	*n = 79* *M =115.58(16.45)*	*n = 158* *M=123.10(17.49)*
	Without (control)	*n = 76* *M = 120.43(15.26)*	*n = 78* *M = 112.10(14.64)*	*n = 154* *M =116.21(15.48)*
	Combined	*n = 155* *M = 125.63(16.01)*	*n = 157* *M = 113.85(15.63)*	

Two-way analysis of variance (ANOVA) was employed to test the research hypotheses. The SAS GLM procedure was used because of unbalanced group size. Overall statistical results (Tables 3) indicate that there were significant differences among groups on both the Comprehension Test [$F(3, 309) = 18.25$, $p = .0001$] and the MIMMS [$F(3, 308) = 21.50$, $p < .0001$].

For the comprehension test, there was a significant difference between the two levels of Intrinsic Motivation (F = 10.13, p = 0.0016) as well as between two levels of Embedded Relevance Enhancement (F = 44.46, p = 0.0001). The interaction between levels of Intrinsic Motivation and levels of Embedded Relevance Enhancement was not significant (F = .01, p = .93). The results show that there was a significant main effect of the Level of Intrinsic Motivation and a significant main effect of the Embedded Relevance Enhancement on the comprehension test. Students with higher levels of intrinsic motivation obtained higher scores than students with lower levels of intrinsic motivation. Students who learned from the embedded relevance enhancement program outperformed the students who learned from the no embedded relevance enhancement program. There was no interaction effect between Level of Intrinsic Motivation and Embedded Relevance Enhancement on the comprehension test.

Table 3 Two-Way GLM ANOVA for Comprehension Test and MIMMS

Source	*df*	*Type III SS*	*MS*	*F*	*p*
		Comprehension Test			
Level of Intrinsic motivation	*1*	*172.54*	*172.54*	*10.13*	*.0016*
Level of Relevance Enhancement	*1*	*756.97*	*756.97*	*44.46*	*.0001*
*LOIM * LORE*	*1*	*.13*	*.13*	*.01*	*.93*
		MIMMS			
Level of Intrinsic Motivation	*1*	*10647.05*	*10647.05*	*44.88*	*.0001*
Level of Relevance Enhancement	*1*	*3640.77*	*3640.77*	*15.35*	*.0001*
*LOIM*LORE*	*1*	*876.79*	*876.79*	*3.70*	*.0555*

*Note. LOIM*LORE = Interaction between Level of Intrinsic Motivation and Embedded Relevance Enhancement.*

For motivation perception, the results showed that there was a significant difference between the two levels of Intrinsic Motivation (F = 44.88, p = 0.0001) as well as between the two levels of Embedded Relevance Enhancement (F = 15.35, p = 0.0001) on the MIMMS. The interaction between Level of Intrinsic Motivation and Embedded Relevance Enhancement on the MIMMS was not significant (F = 3.70, p = 0.0555). Results indicated that there were significant main effects of Level of Intrinsic Motivation and Relevance Enhancement on the MIMMS. The MIMMS mean of the Higher Level of Intrinsic Motivation group was greater than that of the Lower Level of Intrinsic Motivation group. Students who learned from the embedded relevance enhancement program outperformed students who learned from the program without embedded relevance enhancement on the MIMMS. The interaction effect between the Level of Intrinsic Motivation and the Level of Embedded Relevance Enhancement on motivation perception was small and not statistically significant.

The findings indicated that the use of embedded relevance strategies facilitates students' language learning regardless of learners' level of intrinsic motivation. Appropriately constructed CBIM instructional materials with embedded relevance enhancement can benefit EFL learners in English learning. The findings of the study also showed that students with higher levels of intrinsic motivation learned more. More highly intrinsically motivated students performed better regardless of the specific treatments they received. Among all four treatment groups, the highly intrinsically motivated students who learned from the program with embedded instructional strategies program performed the best overall. There was no significant interaction between these two variables. However, a possible tendency toward a differential motivational response to the instructional materials was noted; more highly intrinsically motivated subjects tended to be more motivated by enhanced relevance strategies than less intrinsically motivated subjects.

Discussions and Implications

Findings of this study support Keller's (1983, 1987) declaration that embedded instructional strategies can enhance learners' motivation, which, in turn, can enhance cognitive performance. This finding is consistent with previous research showing that incorporating relevance strategies into instructional materials can increase students' motivation (Means, Jonassen, and Dwyer, 1997; Nwagbara, 1993; Sass, 1989). It also supports Keller's (1983) theory of motivation, which argues that learners' motivation can be influenced, and the ARCS model, which provided the set of strategies for improving motivation in this study. The results also indicate that the effects of the two variables are additive. The embedded instructional strategies added to the effect of the existing intrinsic motivation of students. The results of the study suggest that students can learn better when they are notified of the immediate benefit of the instruction they receive; when there are examples included in the material to stress the intrinsic satisfactions of the subject of instruction (goal orientation: present worth). Students learn better when they know what they will be able to do after finishing the instructional materials; when there are examples and exercises clearly related to the knowledge and skills that they will need in the future; when they are told that this instruction will improve their general life coping skills (goal orientation: future value). The results also suggest that learning is facilitated by employing (1) personal language to make learners feel that they are being talking as a person, (2) exercises with feedback, and (3) exercises that stimulate problem solving (motive matching: basic motive stimulation). EFL teachers may draw implications for classroom practice from this research. Teachers should talk with students as people; relate instruction to students' daily lives; and point out how the instructional materials can be used in the real world or in students' lives in the future. Teachers should also try different styles of exercise. Some problem solving exercises, in addition to basic language practice, can help students' learning. Relevance enhancement facilitated students' learning in this study.

The positive findings should encourage teachers and program designers to use embedded instructional strategies either in class or in courseware design. Instructional designers are encouraged to use the ARCS model as a model for designing motivating instruction. Based on the learner assessment, instructional designers can (1) integrate the whole ARCS model into instructional materials, (2) embed one of the components of the model into instructional material, or (3) apply strategies listed on the motivational tactics checklist, to enhance learners motivation and improve learning. Future research should further examine the use of relevance enhancement strategies. Also, other components of the ARCS model, such as attention, confidence, or satisfaction should also be studied for their impact on learning. This theoretical framework offers a rich source of instructional strategies for teachers and instructional designers.

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Pennsylvania State System of Higher Education School Web Site Review for Usability And Information Availability

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Study Design

This study compares and contrasts the web sites of the fourteen Pennsylvania State System of Higher Education schools to identify those that provide efficient, accurate, and effective access to a standardized list of information resources. The study takes a two-fold approach to achieve this goal. By examining the content provided and further analyzing the presentation of that content, an evaluation can be made, and a comparison can be drawn between institutional web sites. The researcher first visited each school's web site in August of 1999 and used the same instrument to revisit the web sites in May 2000 and March 2001 looking for twenty specific pieces of information common to all state system schools.

Each of these twenty items was evaluated based on five criteria:

1. Does the school's site provide the requested information?
2. How difficult is the information to locate?
3. How current is the information?
4. Does the page use appropriate design skills and contain necessary navigational elements (as defined by Patrick Lynch's *Yale Web Style Manual* [Lynch & Horton 1999]
5. Is the page professional in appearance?

A point value from one to five was used for each of the above questions for a total of 25 points. These 25 points could be accumulated for each of the 20 information items that were researched. A total of 500 points were possible.

Assessment criteria assumptions

As the Internet continues to grow, a school's web site is increasing becoming marketing, recruitment, and public relations tools that educational institutions need to closely monitor. A recent survey by the Slippery Rock University Admissions office indicated that the school's web site was second only to family and friends in influencing their decision on applying to the institution [Bracco 2000]. The importance of a school web site outlining accurate and detailed information for prospective students is clear. A well-designed web site providing information that matches the audiences' needs will result in higher enrollment, increased alumni donations, and a greater level of credibility for the institution [McCollum 1999].

This study makes the following assumptions in the collection and analysis of data:

- University sites should all provide a baseline of information resources
- University site visitors should be able to easily locate information without searching deep into a site hierarchy
- University site pages should provide current information
- University site pages should have a professional appearance (good grammar, accurate spelling, consistent layout)

Identification of common information

University web sites are designed to serve a variety of target audiences. These audiences include but are not limited to: prospective students, current students, alumni, institutional employees, community members, researchers, and colleagues. Since university web pages are expected to serve a variety of users, a list of information that these groups might request was generated. That list was refined to twenty items that would be typical of the SSHE institutions. Those twenty items include:

1) Search engine
2) Site Map
3) Tuition and fee schedule
4) Academic Calendar
5) Distance education course offerings
6) Library resources
7) Address of the institution
8) Registrar's name and address
9) How to order transcripts
10) Department listings
11) Academic department chair (English)
12) Mission Statement

13) List of degree and certificate programs
14) Admissions information
15) Name of the President
16) Name of the Provost
17) Calendar of Events
18) Link to State System of Higher Education
19) Faculty directory
20) Alumni page

Data Collection

All data for each of the fourteen schools was collected during the first week of August 1999, the second week of May 2000, and the second week of March 2001. The researcher accessed each web site attempting to locate the information from the list. Search engines, directories, and browsing techniques were used to locate information. The following point scale was used for evaluating question #1; "Does the school's site provide the researched information item?"

5 points – requested information is provided
3 points – some of requested information is provided
1 point – requested information is not located

If the information was not located, the institution received zero points for the remaining four questions. The minimum score any school could receive on any of the items was one point. Therefore, the lowest possible score was 20, and the highest possible score was 500.

Once the information was located the shortest path to accessing the information was determined. Significantly if the information was located via a search engine, the researcher needed to determine how this information was linked to the main page (on what level of the hierarchy did it reside). The assumption for evaluation is that if the user has to review fewer pages to find the requested item, it is easier for them to locate the information. The following point scale was used for question #2, "How difficult is the information to locate?"

5 points – required access of three or fewer pages
4 points – required access of four pages
3 points – required access of five pages
2 points – required access of six pages
1 point – required access of seven or more pages

The web page that contained the requested information was evaluated to determine if the information provided was current. Many pages list a last date of revision. Other dates could be determined by the content on the page. These dates were used for the evaluation. If no date of revision is provided, the researcher assumed that information was current unless there were overt indications otherwise (i.e. calendar of events for a previous year). The following point scale was used for question #3, "How current is the information?"

5 points – requested information is less than 6 months old
3 points – requested information is less than 1 year old
1 point – requested information is more than 1 year

Question #4 evaluated the web pages use of good design skills. Patrick Lynch'*s Yale Web Style Manual* provided the standard for evaluation. The researcher looked critically at only the most elementary of design skills. Did links on the page work? Were graphics used on the page able to load? Were consistent navigational tools employed? Were text colors and size appropriate and readable? The researcher limited the evaluation to three responses to question #4, "Does the page use appropriate design skills and contain necessary navigational elements?"

5 points – page uses excellent design skills
3 points – page uses average design skills
1 point – page uses poor design skills

The final question looked at the page's professional appearance. Does the page use proper grammar, punctuation, and spelling? Is the information organized and presented in a logical format? The researcher will again limit the responses to question #5, "Is the page professional in appearance?"

5 points – page is professional in appearance
3 points – page has one or more spelling, grammar, or punctuation errors; or page is poorly formatted
1 point – page has multiple errors and/or is poorly formatted

Data Analysis

Previous reports have discussed the finding of the first two rounds of data collection. This analysis reviews the data collection that took place during the second week of March 2001. The researcher visited each of the fourteen SSHE school websites looking for the informational items. Internet Explorer 5.0 was used with a screen size set to 600 x 800. All sites were accesses via a 56k modem via an independent Pennsylvania Internet service provider. Scores were totaled for all of the twenty information items and a cumulative score was tabulated for each institution. The individual scores for each of the twenty elements for each school can be found in Appendix A. The following table is a summary of the cumulative scores for each of the three past years.

	1999	2000	2001
	Total (Rank)	Total (Rank)	Total (Rank)
Lock Haven	341 (11)	421 (4)	486 (1)
California	368 (8)	409 (6)	468 (2)
Millersville	398 (4)	463 (1)	466 (3)
Clarion	392 (6)	394 (8)	462 (4)
Mansfield	319 (13)	363 (11)	460 (5)
Slippery Rock	400 (2)	399 (7)	439 (6)
Bloomsburg	369 (7)	420 (5)	433 (7)
Shippensburg	393 (5)	394 (8)	431 (8)
Indiana	393 (3)	451 (2)	425 (9)
Kutztown	339 (12)	384 (10)	423 (10)
West Chester	432 (1)	439 (3)	414 (11)
East Stroudsburg	343 (10)	350 (12)	414 (11)
Edinboro	360 (9)	319 (13)	346 (13)
Cheyney	280 (14)	254 (14)	316 (14)
mean	366	390	427

Table 1 Cumulative scores and rankings for the past three years for each of the fourteen Pennsylvania State System of Higher Education schools.

The average total score has increased each year, and this has had an impact on schools' rankings. West Chester, who ranked 1st after the year of data collection, is now ranked 11th because their score decreased by 18 points over the three year period. Shippensburg, who has seen an improvement in their score each year, has fallen from 4th to 8th position. The lesson to be learned is that if you are not actively working to improve your site, you are falling behind the competition. A web site is a constantly evolving product that needs to be actively molded, revamped, and updated. A stagnant site reflects poorly on an institution and is not accomplishing and promoting their mission.

These scores reflect a snapshot of institutional web pages during the collection period. They are a single perspective on usability and information availability to help schools identify weaknesses in their sites.

Summary

Users are frequently relying on more advanced navigational aids to find information. The need for a search engine and a site or index map has become increasingly more important. Because of the quantity of information that is being delivered at most of the institutional sites, the location or organization of information in the hierarchy is not always intuitive. Some links fall under department's representative areas as a result of institutional history rather than traditional form. The number of schools that provide search engines jumped from five in 2000 to eleven in 2001. The three schools that do not provide a search engine on their site recorded the three lowest scores. Only six of the schools currently provide a site map or site index. The schools that did provide a site map provided an outline view of the site hierarchy. A few schools used the site index approach, which alphabetized all the major pages located on the site. The researcher found the alphabetized approach easier to locate specific information.

Several of the information items that were searched for are well represented at all the institutions. All schools recognize the importance of providing admissions information, library links, an academic calendar, and the address of the institution. All but one of the schools provided tuition and fees information, registrar's name, transcript information, department listings, the chair of the English department, a link to the State System web page, faculty directory and an alumni page. There is confusion at some sites concerning the distinction between department listings and degree programs. One site provided identical links to both listings. The listing of degree programs offered by an institution is a critical element to be linked on the admission or prospective student areas. By forcing students to search through the department listings, schools risk alienating the student because the information is difficult to locate or may not be available at the department level.

The required element that generated the highest mean score was the academic calendar. In March 2000, the department listings provided the highest mean score. The academic calendar provides critical information to those on campus, but also to prospective students, off-campus organization, and those at sister institutions. It is no surprise that the administration sees the academic calendar as an imperative in constructing a web site.

There is little argument that the Internet, web design, and institutional sites are in the early stage of their evolutionary process. The playing field continues to change, and standards are modified as hardware, software, and user behaviors change. Designers must attempt to create pages that reflect current usage statistics for their audience.

A recent study by Mycomputer.com revealed that 49.5% of users are reviewing web pages with a screen resolution of 600 x 800 and that less than 10% of users still use 640 x 480 as their preferred resolution size [Lake 2001]. While these types of hardware and software profiles change over time, current designers need to create screens that meet the profiles of the majority of their visitors. Therefore as pages were analyzed for this study, they were reviewed using a screen resolution setting of 600 x 800. If the schools' pages did not format correctly to this screen size, points were deducted related to graphic design. A few schools had home pages that were designed for 1024 x 768 screen sizes. This caused the content to be cropped and forced the user to scroll down and to the right to review all the information.

For the first time this study collected data on how long it takes for an institutions web page to load. A recent Jupiter Research survey showed that 84% of users indicated that they left sites because of slow or broken links [Lake 2001]. Optimizations of images and being cognizant of the total file size for the university's main home page is an imperative factor in web site design. The researcher used a 56k modem on a 550mhz PC connected to a Western Pennsylvania Internet service provider. The data was collected between 11 a.m. and 12 p.m. on a Friday. This time was selected to test the schools' sites during a period when it would normally be receiving heavy traffic. Given that 88% of households connect to the Internet at 56kps or less, it is easy for designers at institutions with T3 line access to forget that download times can be critical [Lake 2001].

The data collected on download times was not factored into the final score for each school. Future studies may include a factor related to download times. The collection of this information came from the researcher's frustration of slow download times while reviewing the individual sites. One of the SSHE school's home page took over six minutes to load, while the average for the schools was over three minutes. Perhaps some of the slow response time can be attributed to SSHEnet, the State System of Higher Education Network. If the bottleneck for delivery is the network, SSHE schools still need to take this into account as they design pages, particularly pages for prospective students, alumni, or other outside groups. Many of the schools that reported low times had extensive graphics files (some with over 60 files) or rotating color slide shows on their home page. Edward Guttman, lead designer at Viant, a web development firm, notes, "Only if you can prove that users will get added value through enhanced site features are they worthwhile" [Lake, 2001]. While these slideshows may provide wonderful images from the admissions view book, their slow load time outweighs any aesthetic value they may add to the page.

Shippensburg and a few other schools have begun to address the multi-audience design considerations through the use of an Intranet, a portion of their web site designed primarily for on-campus personnel and students. While some off-campus access takes place on this Intranet, the design considerations can reflect that most of the users will have high speed access. This strategy may be appropriate for some of the schools.

One school still uses a cover page on their site. Cover pages are graphical pages that load as a preamble to a site. They provide minimal content and usually only one or two links to proceed into a site. Their effectiveness verses their annoyance has been debated [Lynch & Horton 1999]. The majority of site critics feel they simply create an additional barrier between the user and the content. However, they can provide some functionality by preloading images for graphically intensive sites.

After the completion of the data collection, a follow-up question was sent to each of the schools asking, "Do you employ a full-time webmaster?" and "What division in the institution is responsible for maintaining the school's web site?" The following table provides the results of these questions for each of the schools.

Ten of the fourteen schools indicate that they have full-time webmasters, although Shippensburg splits this responsibility between two people. The top five schools in the study analysis all have full time webmasters.

The responsibility of the web site broke into two distinct areas, although sometimes this was a shared effort. Seven schools indicated that the Advancement or Public Relations (normally a division of Advancement) areas were primarily responsible for the content and updating the schools' pages. Four schools indicated that an Information Technology area held that responsibility. Three schools have joint responsibility between the IT and Advancement/Public Relations areas. The top four schools in the instrument analysis either had Advancement/Public Relations or joint responsibility.

	Webmaster	Division
Lock Haven	Yes	Advancement
California	Yes	PR
Millersville	Yes	IT/PR
Clarion	Yes	Advancement
Mansfield	Yes	IT
Slippery Rock	No	IT
Bloomsburg	No	Advancement
Shippensburg	Yes*	IT
Indiana	Yes	Advancement
Kutztown	Yes	IT/PR
West Chester	Yes	IT
East Stroudsburg	No	Acad Comp/PR
Edinboro	No	PR
Cheyney	Yes	Advancement
	* Two 1/2 time	

Table 2. "Does the institution employ a full-time webmaster?" and "What division at the institution is responsible for maintaining the school's web site?"

A few years ago it was easy to determine the area of responsibility of a school's web page by looking at the images and information organization. Schools that attempted to replicate their view book in the first few pages of the hierarchy were normally created by public relations areas. School's web pages that pushed items like e-mail instructions or ftp links in the upper levels of the site were probably developed by the IT divisions. While these distinctions are not as clear today, there are design issues that are addressed differently by both areas. The IT area may sometimes choose solutions that are technologically efficient and require less maintenance. For instance, the choice of searchable databases for faculty and staff directories may be determined by software availability and efficiency rather than usability. In contrast, sites developed by advancement areas may become too graphically intensive and slow to load in an effort to accomplish the "branding" requirement.

In the brief period of time that this study has been conducted, a maturation of many of the SSHE school web sites has taken place. Early sites relied heavily on organizational structure to dictate the organization of information on institution's web site hierarchy. Next came the revelation of designing for the audience and sites grouped all their content around audience expectations. Many sites have now moved to a hybrid model melding the two with a heavy focus on the audience but some additional organizational structure from the institution included. The past three years has seen a consistent improvement of most SSHE school web sites, however the work is never complete. Schools need to be constantly, reevaluating their audience, reviewing their content organization, and revising their pages to reflect the changing dynamics.

Suggestions for Further Research

Several follow-up or study reviews may be incorporated in future reviews. The researcher felt that the top rated site was not necessary the most aesthetic of the sites. The instrument does a much better job of evaluating the information architecture of a site rather than the visual design. Perhaps a second phase of this study could review just the graphic design.

One way to provide credibility to this study would be to identify a correlation between these ranking and inquires for applications and enrollment. In theory, schools with better web sites should see an increase in inquiries, particularly electronic inquires. After three years of using the same information items, it is probably time to generate a new list for review. A review of the SSHE imperatives document may provide ideas for new items to include. In addition, some schools may become savvy of the study and specifically improve their pages to score higher.

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Selecting Computer Mindtools: A Tool for Constructivist Learning

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Introduction

A number of media selection models have been introduced over the last few decades (Anderson, 1976; Briggs and Wager, 1981; Gagne and Briggs, 1979; Gropper, 1976; Kemp, 1980; and Reiser and Gagne, 1983). These models were designed to assist educators and trainers in selecting the most appropriate media for an instructional situation. A common assumption undergirding these models is that instruction is based on a transmission model of learning in which an instructional medium (e.g., computer, teacher, television) delivers or transmits an instructional message to a learner. This assumption is often inadequate for educators interested in selecting media for constructivist learning environments.

From a constructivist learning perspective, students do not learn "from" technology, but rather "with" technology (Jonassen, 2000). The concept of learning with technology focuses on the intellectual partnership between the learner and the computer. Jonassen refers to computer technologies applied in this manner as Mindtools. These tools partner with learners to engage and facilitate higher order learning and critical thinking. Using Mindtools in schools is often more feasible than other computer applications because Mindtools are relatively inexpensive and they are often already available.

This tool was developed to help educators make informed decisions about the most appropriate Mindtool for students to partner with in specific instructional situations. Instead of focusing on transmission attributes of media (e.g., motion and/or sound capabilities), the tool interacts with and asks educators to specify the critical, creative, or complex thinking skills they want students to develop within a given content domain. Once this information is entered, the educator is given a prioritized list of Mindtools and activities that could effectively be used to help students develop the higher-order thinking skills specified. It will be useful to all educators who are interested in resources that can support their efforts in designing constructivist learning environments.

Constructivist Learning Environments

Constructivists believe that we construct our own knowledge based on our own experiences with reality, through reflection on our interactions with objects and ideas (Brooks & Brooks, 1993). From this perspective, learning occurs through the continual creation and revisions of rules and hypotheses to explicate what is observed (Brooks, 1990). Learners act more like active participants rather than passive recipients during the learning process. In the learning process, each person is continuously examining new information with respect to old rules. Rules are revised when discrepancies appear until reaching new understandings or constructions of reality.

Based on the belief that we learn by constructing our own understandings of reality, contructivist learning environments should be student centered, allowing students to take an active role exploring, inquiring, and solving problems. In addition, educators should encourage students to experience an abundance of objects and ideas while empowering them to ask their own questions and seek their own answers to the complexities of reality. This pedagogical perspective often leads to assignments and materials that are interdisciplinary and integrated and to instructional methods that focus on student-to-student interaction. In such learning environments, students are more likely to take risks and approach assignments with a willingness to accept challenges to their current understandings (Brooks & Brooks, 1993). Such environmental conditions honor students as emerging thinkers and engage students' active understanding with reference to past experiences and personal purposes.

Brooks (1990) stated that models of learning based on constructivist principles suggest a sequence of lessons in which exploration comes first. In contrast, traditional instruction often focuses on information dissemination for the majority of instruction and may only introduce exploration after all the material has been "taught". Brooks (1990) suggested a three-stage model from constructivist-based science education as a means of applying constructivism across the curriculum: the exploration stage, the invention stage, and the discovery stage. Using this model, teachers engage students with lesson concepts by allowing them to explore materials or information (exploration stage), then by formally introducing the concepts (invention stage) and finally by providing students with further activities (discovery stage). This sequence enables students to develop a robust usable knowledge base within a domain.

Constructivist learning is a complex interaction between the students' disposition, personal purposes, prior knowledge, and the requirements for specific subject-matter inquiry (Henderson, 1996). In constructivist learning environments, instead of asking the learners to memorize and practice rote skills, educators inspire and facilitate meaningful inquiry learning.

Mindtools for Constructivist Learning

Mindtools can be an especially effective way to augment contructivist learning experiences in the classroom. Mindtools depart from the conventional use of instructional technology because of the intellectual partnership that is created between the learner and the computer. In other words, when the learner works with the computer, the learner enhances the capabilities of the computer, and the computer in turn enhances the thinking of the learner (Jonassen, 2000). In this way, the computer becomes an intellectual tool that learners can use to engage and facilitate critical thinking and higher order learning. Jonassen explains that the properties of Mindtools enable learners to make more effective use of their mental efforts and create knowledge that reflects their comprehension of the information rather than replicating the teacher's presentation of information (p. 10). When students use Mindtools, knowledge is built by the student, not provided by the teacher.

When teachers use Mindtools to promote meaningful thinking, they facilitate learning by incorporating appropriate Mindtools to help students think critically about the subject matter. Lessons are effectively implemented by using exploration, invention, and discovery as the framework for classroom learning experiences. Using Mindtools in schools is often more feasible than other computer applications because they are relatively inexpensive and they are already available in most schools. However, as Jonassen suggests, there is no reason to limit the concept of Mindtools to computer-based resources alone. Any medium that supports knowledge construction, manipulation, representation, exploration, communication, and reflection could be considered a Mindtool.

The Computer-based Tool for Selecting Computer Mindtools

Although computers have been used for teaching and learning for a long period of time, the idea of making use of computer Mindtools is still pretty new to educators. A search of the WWW and the literature yielded few resources or research that addressed the integration of Mindtools in the practical teaching and learning environment, the school. There were numerous broken links, which were meant to link to the pages relevant to Mindtools, all over the Internet. In addition, there were misconceptions or misunderstandings about Mindtools in current Internet resources. Teachers have access to few resources to assist them in designing lesson that incorporate Mindtools and have little opportunity to get familiar with using Mindtools in their classrooms. It is confusing and frustrating. In order to help educators to implement Mindtools, a computer-based tool for selecting computer Mindtools is being designed. This tool would utilize a database web server to provide educators examples or suggestions according to the educators' specific needs and inquiries. This easy to use tool will assist educators to include the utilization of Mindtools in the learning environment which should ultimately increase the critical thinking skills of the students. This session will discuss and explore the development of this selecting tool, how it is evolved.

Selecting media for instruction (Reiser & Gagné, 1983)

A number of media selection models have been introduced over the last few decades (Anderson, 1976; Briggs and Wager, 1981; Gagne and Briggs, 1979; Gropper, 1976; Kemp, 1980; and Reiser and Gagne, 1983). These models were designed to assist educators and trainers in selecting the most appropriate medium for an instructional situation. A common assumption undergirding these models was that instruction is based on a transmission model of learning in which an instructional medium (e.g., computer, teacher, and television) delivers or transmits an instructional message to a learner. This assumption was perhaps best articulated by Reiser and Gagne (1983) when introducing their media selection model by defining media as " . . . the physical means by which an instructional message is communicated" (p. 5). They further stated that educators and trainers are faced with the " . . .problem of choosing the appropriate media to deliver an instructional message" (p. 3). The focus on media as the communicator or deliverer of an instructional message is consistent with many traditional models of instruction (Salomon, Perkins, & Globerson, 1991). However, this assumption is often inadequate for educators interested in selecting media for constructivist learning environments. This assumption is what Jonassen would call "learn from computers." The leaner under this assumption merely receives instructional massages from the media and learns with a passive role. Neither the interaction nor the partnership with the media is encouraged or promoted.

Discrepancies of Reiser & Gagnés' assumption for constructivist learning environment

Based on the assumption of media as " . . . the physical means by which an instructional message is communicated" (p. 5), Reiser & Gagnés' media selection model implies that media are merely delivery tools not cognitive tools. There are several discrepancies in applying Reiser & Gagnés' media selection model to a constructivist learning environment. First of all, Reiser & Gagnés' media selection model the model focuses on selecting media based on the transmission attributes of media (e.g., motion and/or sound capabilities). Selection of media as cognitive tools to engage students' thinking is not addressed in this model.

Second, Reiser & Gagnés' media selection model focuses on providing sound guidelines to instructional designers. In the introduction part of Reiser & Gagnés' media selection model, it indicated that it is "aimed primarily at instructional designers...who design and develop instructional materials" (p. 7). In other words, it is not primarily tailored for classroom teachers or educators who implement their teaching or instructional materials on daily or weekly basis in a practical learning environment, nor does it meet the needs of a constructivist learning environment. Although claimed to be of value to instructors and classroom teachers, their model is only for selecting "media for supplementing or supplanting some of their in-class teaching activities" (p. 7). In a constructivist learning environment, media should not be just for supplementing or supplanting teaching activities but engaging students to think critically.

Third, users need to cross off media which are not feasible in the situation for which instruction is being designed after they have used Reiser & Gagnés' media selection model to identify the appropriate media for them. In other words, users have to identify the appropriate media regardless to the feasibility or availability at the first place. At the end, users might not be able to use any of the selected media that Reiser & Gagnés' media selection model suggests. Moreover, users have to consider the necessity and the comparative costs to make final choices. Consequently, using Reiser & Gagnés' media selection model is still a complicated decision making process. It is time-consuming for classroom teachers and educators to implement Reiser & Gagnés' media selection model. It is another extra workload to their already tight and busy schedules.

Descriptions/constructions of our selecting tool

Mindtools are cognitive tools. Students work with Mindtools in terms of partnerships. Consequently, students and Mindtools empower each other's capabilities, especially the thinking and learning of students and the potentials of Mindtools. Mindtools are readily available and can be used in all kinds of content areas. As a result, Mindtools are the best "media" to the constructivist learning environment. In order to promote the uses of Mindtools and help educators who are interested in applying Mindtools to their teaching, the idea to construct an extendable and applicable Mindtool database resource was developed. In consideration of the availability and the ease to use of the WWW to every educator, it was decided to build a database web server for selecting computer-based Mindtools. This tool is intended to help educators make informed decisions about the most appropriate Mindtool for students to partner with in specific instructional situations. The tool interacts with and asks educators to specify the critical, creative, or complex thinking skills they want students to develop within a given content domain. Once this information is entered, the educator is given a prioritized list of Mindtools and activities that could effectively be used to help students develop the higher-order thinking skills specified. The selection tool employs five steps to guide users in the identification of appropriate Mindtools. Users will first be asked to specify content area and the grade level. Next, users need to select concepts, the desired critical cognitive thinking skills of students to engage, and check the availability of their computer applications, all from pre-decided menus. Then, based on the input of users, a prioritized list of Mindtools with short descriptions of example activities and guidelines to construct new activities is provided. Items on the prioritized list are links connecting to corresponding pages of examples stored in the database web server for selecting Mindtools.

Discussion and Conclusion

The tool is still under development. It is not a sound product yet at this point. It is the idea that counts for the purpose of helping educators to select appropriate Mindtools for their constructivist learning environments. However, this presentation will still show how this tool works practically. Sample pages will be provided to illustrate the constructions of the idea of this Mindtool database web server.

The functions to identify inputs are embedded on web pages. Queries are sent to the database server in terms of submitting web forms. Data are retrieved from the collection of the database. Then, results are returned and shown on users' web pages using server side scripting language. In other words, in order to develop this database web server for selecting Mindtools, a database server, a server side scripting language, and a Web server are required. In this case, we are using MySQL as the database server that serves databases, PHP as the server side scripting language that connects a database server to fetch information and sends the information to users' web browsers as designed web pages, and the Unix Web server of Texas Tech University. MySQL and PHP are chosen because of their free distributions and their availabilities. Moreover, MySQL and PHP are compliant with the Unix Web server of Texas Tech University.

The Mindtool database is built based on Jonassen's book "Computers as Mindtools for Schools." We used Jonassen's terms to specify the types of Mindtools as well as the computer application software. The terms for the desired critical cognitive skills are put together based on various resources regarding to critical thinking. The lists of content and subject areas are relevant to what is taught at secondary schools. However, building the database is much of work. While working on sample activities, we confront a serious problem regarding to content and subject areas. It will be very difficult and unreasonable to build the content and subject specified activities without consulting with real content experts. It needs content experts to design and create lesson plans and activities.

Moreover, if the database we are building is a closed collection, the resources for educators who are interested in Mindtools will be unexpandable and remain limited. In order to have the database possess the capability of ongoing expansion, we have decided to add a function, other than guidelines to help users to create lesson plans and activities, which allows any potential user to contribute their creative activities to the collection of the database. We believe that once the user is more familiar with the application of Mindtools, they will be more ready to create their own or to contribute their ideas to the database. The contribution function is tailored for them. Nevertheless, not every contribution is published or added to the database automatically. To prevent false example activities or misconceptions of applying Mindtools, every contribution is sent to a reviewer first prior to be a part of the database. Full considerations are necessary and also take much time and efforts. In other words, the development of this Mindtool database web server requires all kinds of participations on technical solutions, content specified expertise, ongoing reviewing, continual revision, and user engagements. This selection tool for Mindtools is meant to be a collaborative work. By working with the collaboration of all aspects, this tool will work more effectively.

It is not possible to construct this tool soundly without involving intended users. That is one of the reason that the tool is to be on the Internet. This tool is made to be a share resource of Mindtools.

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Effects of On-Line Peer-Support on Learning During On-Line Small Group Discussion

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Abstract

The purpose of this study is to investigate learning effects of on-line peer-support for generating critical questions and counter arguments in small group on-line discussion. The on-line peer-support includes descriptions of what to do and generic and domain specific examples of questions. About forty five students were recruited from an on-line introductory class on turfgrass management offered by a land-grant university. A field experimental time series design with control-group was employed. Data were collected from five discussion sessions, ten open-ended essay exams, and three multiple-choice exams through a semester. The results indicated that the peer-challenge guidance helped learners to generate more challenges ($F=2.465$, $p < .05$). But, it did not improve the quality of challenges. The increased quantity of challenges alone might be not sufficient to activate learners' reflection and critical thinking or to improve meaningful interactions. Consequently, it did not influence learning, performance in multiple-choice questions on memory and comprehension and open-ended essay questions.

Background to the Problem

On-line discussion has become one of the most popular strategies used in on-line distance education as well as on-site education at the college level. For example, most on-line education support systems (e.g. WebCT) include various forms of computer supported communication functions, such as list-serve and bulletin board systems (Abowd, da Graca Pimentel, Ishiguro, Kerimbaev, & Guzdial, 1999; Hsi & Hoadley, 1997). In fact, many on-line instructors use these functions to encourage learners to be involved in discussions about target topics (Berge, 1997; 2000). Meaningful discussion helps learners to construct their own knowledge by providing several cognitive benefits such as *articulation*, where learners articulate their understanding, perspectives, or opinions; *cognitive conflicts*, where learners reflect on new knowledge to justify or defend conflicting positions; and *co-construction*, where learners share and refine meaning with peers in a social context (Crook, 1994; Jonassen, Peck, & Wilson, 1999; Koschmann et al., 1996; Tao & Gunstone, 1999b). Although on-line discussion has been used largely with these expectations for learning benefits, the actual effects are unclear. In cases where simple question-answer cycles are employed, students do not become actively involved in critical thinking processes. These non-thoughtful interactions are not sufficient to promote active, knowledge construction.

One possible reason for the lack of reflection during on-line discussions is that students do not know what to ask or how to ask questions (Miyake & Norman, 1979; van der Meij, 1990). Peer interactions can be initiated when learners raise thoughtful questions or provide critical feedback; however, in order to propose important questions or thoughtful feedback, question-askers need to have a certain level of domain knowledge and to activate metacognitive skills such as reflection, monitoring and evaluation (Dillon, 1986; Miyake & Norman, 1979; Palincsar & Brown, 1984; van der Meij, 1990; Wong, 1985). Unfortunately, novice learners who begin to explore a new domain are often limited in those metacognitive skills, so they can neither ask the right questions nor generate productive feedback. It is a "metacognitive knowledge dilemma" (Land, 2000), whereby effective monitoring and reflection is linked to having some prior domain knowledge (Garner & Alexander, 1989).

This dilemma provides an essential need for developing on-line instructional strategies that can guide meaningful on-line discussion between or among peers (e.g. Abowd et al., 1999; Scardamalia & Bereiter, 1996a). Specifically, learners' generation of questions or feedback needs to be supported to lead meaningful discussions (Brown, 1989; King, 1994; King & Rosenshine, 1993; Palincsar & Brown, 1984; Scardamalia & Bereiter, 1991; van der Meij, 1998).

Purpose of the Study

This study develops a framework intended to overcome the metacognitive dilemma and to facilitate effective peer interactions in on-line discussion. This framework assumes that novice students who lack domain knowledge and cognitive skills can be supported in generating meaningful interactions at an early stage of learning (King & Rosenshine, 1993; Palincsar & Brown, 1984). The resulting questions and feedback in turn can enhance peers' metacognition, such as reflecting and monitoring, which allows them to refine and restructure their domain knowledge (Piaget, 1985; Webb & Palincsar, 1996). This framework for peer-challenge support has three assumptions. First, on-line support for students to generate meaningful challenges can increase the quality of students' questions and feedback by providing externalized support for metacognition (Palincsar & Brown, 1984). Second, in order to receive learning benefits from on-line discussion, such as articulation, cognitive conflicts, and co-construction of knowledge (Crook, 1994), this peer-challenging strategy should guide specific types of challenges that facilitate these learning activities (Forman & Cazden, 1985). Thus, effective types of challenges should be questions that seek missing information from learners' explanations, counter arguments that contradict learner's opinions, and more systemic questions such as hypothetical questions that force learners to consider complex contexts and various perspectives. Third, once the quality of peer-generated challenges is increased, meaningful cycles of verbal interactions should be initiated. When learners receive critical, valuable, reasonable, and sophisticated questions or challenges from their peers, those challenges and interactions should magnify learner's cognitive dissonance and trigger a conscious cognitive process to re-construct and enhance existing understanding. Thus, the purpose of this study is to test this peer-challenge support framework by investigating the effects of on-line support for peer challenges on discussion activities and learning of college students.

Research Questions

Question 1: Does the use of on-line guidance for generating effective peer-challenges affect students' on-line challenging behaviors such as types of challenges generated, clarity of challenges, and clarity of rationale in challenges during small group on-line discussion?

Question 2: Does the use of on-line guidance for generating effective peer-challenges affect students' on-line discussion activities (frequency of interactions, threaded responses, and off-task interactions) during small group on-line discussion?

Question 3: Does the use of on-line guidance for generating effective peer-challenges during small group on-line discussion affect students' performance in memory and comprehension?

Question 4: Does the use of on-line guidance for generating effective peer-challenges affect changes in students' performance of open-ended essay questions during small group on-line discussion?

Methods

Participants

About forty five students were recruited from an on-line introductory class on turfgrass management during the 2001 spring semester, which is regularly offered from a land-grant university in the northeastern United States. The audience for this on-line course has no restriction in their location and time. They can be full- or part- time students working toward either a degree or a certificate. In the 2001 spring semester, the majority of the participants were part-time male students who pursued a certificate for turfgrass management. The participants were randomly assigned to a small group of five to six members. Then those small groups were randomly assigned to either experimental or control group.

Discussion tool and intervention

An on-line discussion tool used for this class is called Collaboration and Negotiation Tool for Case-Based Learning (Conet-C version 1) and was designed by the authors.

Guidelines for effective peer-challenges were embedded into the discussion tool to facilitate learners' generation of three different types of challenges to their peers' initial answers: clarification questions, counter arguments, and context- or perspective-oriented questions.

Clarification questions are peer-generated questions seeking additional information from learners' initial answers for clarifying or elaborating the learners' ideas. These questions identify missing information, indicate unclear parts, and detect errors in learners' initial explanations on given topics. This type of peer-challenge could facilitate learners to elaborate/articulate their idea, explain these idea clearly, and correct their partial misunderstanding (Koschmann et al., 1996; Tao & Gunstone, 1999a).

Counter arguments are peer-generated opinions expressing disagreements with learners' initial ideas. Unlike clarification questions, these opinions identify major differences between peers' and users' understanding on given topics. This type of peer-challenge generates explicit cognitive conflicts which could encourage learners to justify their positions, reconstruct their misconceptions, and negotiate their understandings (Tao & Gunstone, 1999a).

Context-/perspective-oriented questions are hypothetical questions changing critical factors in given problem situations or considering different perspectives on the problems. Unlike clarification questions or counter arguments, these challenges do not indicate any specific problem with learners' responses. Instead, these challenges could stimulate learners to systemically think about dynamic aspects of the problems beyond the levels of the assigned questions. This type of peer-challenge could facilitate learners to generate predications and explanations.

Procedure

Small groups of students were asked to answer the same set of five or six open-ended essay questions in five sessions of on-line discussion throughout the semester. At each session of discussion, students in each group were asked to answer their assigned question and post their answer within a week, so the initial answers were available for group members to review. Then, each student was required to ask questions or to provide different opinions at least two times to group members in each discussion session. At the same time, each student was asked to answer peers' questions or counter opinions about his/her initial answer. After completing each on-line discussion (approx. 1 week), each student revised his/her initial answer and submitted the final answer to the instructor.

During the first two discussion sessions (pre-observation), there was no treatment given to the groups. After finishing the second discussion session, all students took a multiple-choice exam (pretest for memory and comprehension) in their local area administered by local librarians. In the third and forth discussion sessions (treatment observation), the guidance for effective peer-challenges was presented to only the experimental group through the on-line discussion tool. After finishing the forth discussion session, another multiple-choice exam (post-test) was administered. In the fifth discussion (post-observation) no treatment was given to the groups. After this last discussion, the last multiple-choice exam (delayed and transfer test) was administered.

During each discussion session, students' on-line verbal interactions and their initial and final answers for the given open-ended essay questions were recorded in a computer database for later analysis.

Independent variables measured

The followings are a list of independent variables measured.

- Challenging activities
  - Challenge types: frequency of peer-generated clarification questions, counter arguments, and context-/perspective oriented questions.
  - Challenge clarity: how clearly peer-generated questions or disagreement points are described.
  - Challenge-rationale clarity: how clearly rationales for challenges are justified.
- Discussion activities
  - Interactions: frequency of all postings
  - Threaded responses: the number of postings under one issue
  - Off-task discussions: frequency of off-task postings
- Learning outcomes
  - Multiple-choice tests of memory and comprehension
  - Open-ended essay questions

Results

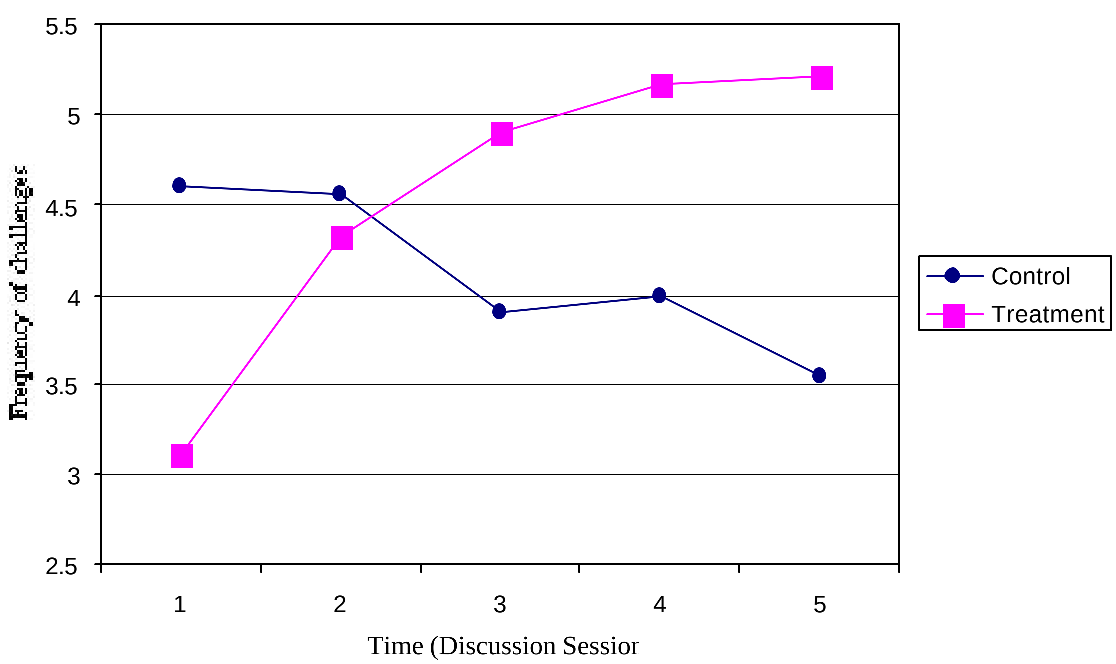
Effects on on-line challenging behaviors

The frequency of three types of peer-generated challenges (clarification questions, counter arguments, and context-/perspective-oriented questions) were counted from the five discussion sessions respectively. According to the results of ANOVA repeated measures on the total frequency of three types of challenge generated during discussion sessions (see Table 1), there was a statistically significant interaction effect for time and groups ($F = 2.465$, $p < .05$). The result indicates that the treatment group generated more challenges than the control group during and after treatment sessions (see figure 1). In the post-hoc analysis, however, it failed to find specific time points and types of challenges that were attributable to the significant interaction effect.

Table 1. Results of ANOVA on total frequency of three types of challenges

Source	Sum of Squares	df	Mean Square	F	Sig.
Time*	3.995	4	.999	.466	.761
Time X Group	21.137	4	5.284	2.465	.048
Error (Time)	317.229	148	2.143		

Figure 1. Total frequency of three types of challenges between control and treatment groups across five discussion sessions.



In order to obtain the scores for challenge clarity and challenge-rationale clarity, the challenges posted during discussion sessions were also evaluated by two judges according to rubrics. The results of ANOVA with repeated measures did not show any significant differences between two groups in both challenge clarity ($F = .608$, $p. < .658$) and challenge-rational clarity ($F = .356$, $p. < .839$) across discussion sessions.

Effects on on-line discussion activities

The frequency of all postings and off-task postings were counted throughout the five discussion sessions. Also, the average number of postings under each issues (threaded discussions) was calculated by dividing the number of issues into the number of all postings. The results of ANOVA with repeated measures of the on-line discussion activities did not show any significant differences between the two groups across all discussion sessions in the frequency of postings ($F = .832$, $p. = .507$) or off-task postings ($F = 1.227$, $p < .302$). In addition, the results of threaded discussions calculated from each small group did not show any consistent patterns of the curve in the average postings under each issue. This indicates that there are no clear differences between the two groups in threaded discussions.

Effects on memory and comprehension tests

The multiple-choice scores on memory and comprehension from pre-, post-, delayed-, and transfer tests were collected and analyzed by ANOVA repeated measures. The ANOVA results did not show any significant difference between the two groups in the scores across all tests ($F = .060$, $p = .981$).

Effects on changes in open-ended essay questions

The initial and final answers of students on the open-ended essay questions in each discussion session were collected and evaluated by two judges according to given rubrics. The ANOVA results did not show any significant difference between the two groups in the gain scores made from initial to final answers across all discussion sessions ($F = 1.101$, $p = .358$).

Discussions

In summary, the results indicated that the peer-challenge guidance helped learners to generate more challenges. But, this did not improve the quality of challenges. The increased quantity of challenges alone might not be sufficient to activate learners' reflection and critical thinking or to improve meaningful interactions. Consequently, this did not influence learning or performance on multiple-choice questions of memory and comprehension and open-ended essay questions on higher order thinking.

One likely reason for the failure of the treatment to improve the quality of challenges may be that students did not frequently refer to the on-line guidance; it was not strongly emphasized by either the instructor or the interface of the on-line discussion tool.

Instead, it was simply recommended by the instructor only twice during the treatment discussion session through the instructor's announcement board. Thus, students may not have paid attention to the guidance during discussions. In addition, the interface design of the discussion tool may not have strongly encouraged students to look at and use the guidance; students in the treatment group were required to voluntarily seek this guidance by clicking on the guidance icon. Most students reported on a survey collected at the end of the semester that they referred to the guidance only one or two times during the treatment discussion sessions.

Possible solutions to these limitations involve changes to the interface design and class administration, although these might generate additional problems. The guidance, for example, could be re-designed to open automatically whenever students open the discussion window. But, students might want more control without being "forced" to view the guidance for every posting. Another possible solution might be to provide a template for generating effective challenges that required them to go through all steps in order to post their challenges. If, however, we use more sophisticated interfaces for on-line guidance, then we may lose the feasibility of large-scale use of on-line strategies because instructors might find it difficult to incorporate such interface-dependent strategies into the generic discussion tools they use currently. Lastly, instructors might strongly emphasize the use of on-line guidance to students by sending messages to them more frequently.

Although the current study did not find significant effects of using on-line guidance on discussion activities and learning, it showed very reasonable results indicating that the quality of challenges could be essential for meaningful discussion and learning. Further studies need to be focused on finding ways to improve the quality of challenges and need to be tested again to find possible learning effects of the on-line guidance.

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Model of Learner-Centered Computer-Mediated Interaction for Collaborative Distance Learning

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Abstract

Interaction research in distance education has focused mostly on learner-teacher interaction in a learning environment based on a behaviorist curriculum. This presentation focuses on factors contributing to learner-learner interaction in a distance learning course based on learner-centered and collaborative instructional design. The proposed model, which resulted from research on patterns of learner interaction in both synchronous and asynchronous computer-mediated communication modes, examines factors contributing to interaction in the areas of learner characteristics, technology attributes, and learning activities.

Introduction

Interaction research provides important information on student behaviors in distance learning environments to educators, researchers, and instructional designers. The current state of interaction research has focused mostly on the quantitative results of inter-connected messages in computer-mediated communication (CMC) conferences. Contributing factors to interaction such as theoretical principles of course design and learning contexts are largely ignored. While various virtual learning environments and course management systems are being introduced to the distance learning community, it is easy to loose sight on the pedagogical application of the learning systems. Teachers are rushed to learn various state-of-art instructional technologies but not given instructional examples or time to develop well-designed instructional materials for conducting distance learning courses. The issues faced by the educators are similar to that of a novice pilot being rushed to drive a commercial airplane without going through appropriate training via flight simulation. More research on how these systems can enhance student learning and examples of best practices on instructional design in various disciplines are needed for the success of distance education. As interaction has been identified as the key to the success of online learning by researchers (Gunawardena et al., 1997), this study examines patterns of online interaction and the types of instructional design that would enhance online interaction via both synchronous and asynchronous communication.

Learner-centered computer-mediated interaction in this study is defined as reciprocal communication among participants of computer-mediated learning environments that emphasizes learner developments in cognition, motivation, and social advancement for the purpose of knowledge construction and community building. Two theoretical principles that are highly relevant to such interaction are constructivism and learner-centered principles (LCPs). A constructivist distance learning environment places emphases on knowledge construction through interaction with the physical environment and through the appropriation of culturally relevant activities. In other words, knowledge is co-constructed with peers or experts and through the immersion in a social context (Bonk & Cunningham, 1998). The Learner-Centered Principles were developed by the American Psychological Association (APA, 1997) as a framework for the new educational approaches that stress the integration of the needs, skills, interests, and backgrounds of the students into the curriculum planing. The following section on literature review examines the connection between these principles and interaction.

Literature Review

Interaction is often emphasized in different contexts for different purposes, such as construction of knowledge (Gunawardena et al., 1997), and student satisfaction (Hackman and Walker, 1990). Moore (1989) contributed to the discussion of interaction by providing an important framework of three types of interaction: learner-content, learner-instructor, and learner-learner interaction. Moore pointed out that learner-content interaction is a "defining characteristics of education." As a result of learner-content interaction, learners achieve intellectual growth or changes in perspectives. The second type, learner-instructor interaction, highlights the important role of instructors. In addition to defining the learning objectives, activities, and materials, distance instructors are also responsible for revising teaching methods and providing evaluation as their students progress in the process of learning. The third type, learner-learner interaction, takes place between learner and other learners in real-time or delayed time and is not restricted to the presence of the instructor. This "inter-learner interaction" can foster learning through student collaboration and knowledge sharing. Although the strategies used to increase learner-learner interaction vary according to the characteristics and backgrounds of the learners, learner-learner interaction can significantly encourage the development of student expertise in different subject areas and promote community building.

Hillman et al. (1994) added a fourth component on learner-interface interaction to the literature discussion. They defined learner-interface interaction as "a process of manipulating tools to accomplish a task" (p. 34). They stressed the importance of learner-interface interaction because the "learner must interact with the technological medium in order to interact with the content, instructor, or other learners" (p. 33). The learner must be empowered to profess the necessary skills to use the communication tools and feel comfortable with the learning environment. Good interface design can enhance interactivity and minimize technological barriers to online learning.

These definitions also highlight the importance of the interrelationship among learners, content, and technology. In the design of a learner-centered distance learning course, it is important to include the four types of interaction in the design. Furthermore, learner-centered principles also provide "an essential framework to be incorporated in new designs for curriculum and instruction, and assessment systems for evaluating educational goal attainments" (American Psychological Association, 1997, p. 1). LCPs consists of the following areas of learning: cognitive and metacognitive factors, motivational and affective factors, developmental and social factors, and individual differences.

As pointed out by Wagner and McCombs (1995), these principles emerged from the following considerations:

- Learners operate holistically as a function of intellectual, emotional, social and physical characteristics.
- The learner's behavior is based on his or her perceptions and evaluations of situations and events from a self-orientation that interprets meaning and value relevant to personal goals and interests.
- The learner's development across all domains of functioning is never static and unchanging, but is a dynamic growth process that serves inherent needs for mastery, control and belonging. (p. 34)

In the context of distance education, the infusion of LCPs into the design of learning systems and instructional activities has provided enhanced opportunities for educators to improve teaching/learning activities. Traditionally, teachers decide what the learners need to know by devising the objectives, instruction, procedures, curriculum, materials, and evaluation. Recently, the increased discussions on learner-centered education have led more educators to recognize the values of empowering the students to take control of their learning. The design of the curriculum takes into consideration students' background and prior knowledge in the subject matter.

The LCPs provide a solid framework for the new educational approaches. However, the actual implementation is subject to individual interpretation and still requires much effort for educators to come up with feasible strategies. Fortunately, constructivism that originates from philosophical and educational theories has provided viable strategies for teaching and learning. Jonassen et al. (1995), long-time advocates of constructivism for CMC systems in distance education, argued:

> Constructivist principles provide a set of guiding principles to help designers and teachers create learner-centered, collaborative environments that support reflective and experiential processes. Students and instructors can then build meaning, understanding, and relevant practice together and go far beyond the mere movement of information from instructors' minds to students' notebooks. (p. 8)

According to Jonassen et al. (1995), the four constructivist attributes for building learning systems are context, construction, collaboration, and conversation. *Context* refers to the "real world" scenario in which learners can carry out learning tasks as close to the real world as possible. Learning tasks should have real-world implications so that learners can connect what they learn in the classroom with the real world. *Construction* concerns knowledge that is built on the "active process of articulation and reflection within a context" (Jonassen, 1995, p. 8). Learners acquire knowledge better when they can link their own experience with the learning materials and make sense of them. Learners master a subject better in the process of constructing knowledge. *Collaboration* helps learners to develop, test, and evaluate their ideas with peers. Learners are exposed to multiple perspectives in a problem-solving case and then come to a self-selected conclusion on a particular issue. This is an important part of the learning process. *Conversation* is engaged by group members for purposes such as planning, collaboration, and meaning making. It is especially important for distance learning because most communication is done through online exchanges. A successful conversation will lead to good preparations for and completion of online tasks (Jonassen et al., 1995).

Distance learning courses that are based on the LCPs and constructivism have demonstrated enhanced interaction and academic achievements. The next section reviews the process of implementing the theoretical principles into the instructional design of a distance learning course.

Background

The course for this research is an upper level undergraduate course titled "Theories and Applications of Computer-Mediated Communication Systems" offered at the University of Hawaii. The main objective of the course is to enrich the understanding of CMC systems through discussions and effective use of various CMC systems. The course design is based on the following theoretical principles:

Principle 1: Learner-centered instructional design: The course design considers student development, especially in the following areas: cognitive, meta-cognitive, motivational, affective, social, and individual differences. Students learn to monitor their own progress, manage the course content, and develop expertise in a sub-domain of CMC study. Specific examples of learner-centered instructional activities include the use of student reflection journals for the purpose of metacognition and student-centered discussion for motivating them to take control of the subject matter.

Principle 2: Constructivist activities: The emphasis is placed on student acquisition of knowledge via active involvement with the curriculum rather than via imitation or memorization of facts or course content. Specific instructional activities based on the constructivist principles include synchronous and asynchronous discussions for co-construction of knowledge and project-based learning for real-world application.

Principle 3: Small group cooperative learning: Students collaborate on tasks in small groups to accomplish a set of predefined learning objectives and to advance their knowledge in a domain. Emphases are placed on community building and knowledge sharing. They equally share the responsibilities of the assigned tasks and semester projects. At the end of each term, they demonstrate the ability to accomplish the task on an individual base.

The course for this study was conducted through a number of text-based (WebCT chat and ICQ), audio-video conferencing (CU-Seeme & Netscape Cooltalk), and enhanced virtual systems (The Palace & Active World). Students took turns to moderate seminars in three-member small groups each week. They followed the guidelines of Student-Centered Discussions (SCD) (Chou, 1999; Shooop, 1997) to participate in the online seminars. In general, students participated each online seminar by following the SCD principles such as respecting each other, generating ideas, listening tentatively, and referencing each other during conversation. Whereas, student moderators kept the discussion alive by observing rules such as greeting participants, devising warm-up activities, making an opening statement, using a step-by-step discussion process, asking questions, scripting the discussion, and preparing concluding remarks (Chou, 1999), Detailed description of instructional design, course syllabus, and the CMC systems employed are described in the research by Chou (2001a, 2001b)

Research Design and Methods

This study examines interaction patterns at both interpersonal and system levels in a learner-centered distance collaborative learning environment. The research focuses on factors that affect interaction from three areas: learning activities, technology attributes, and learner characteristics. At the system level, student perceptions of both synchronous and asynchronous CMC systems and the relationship with interaction are investigated. At the interpersonal level, patterns of learner-learner interaction over both communication modes are compared and contrasted. Furthermore, the overall effects of various theoretical-based instructional activities on learner interaction are also scrutinized. The research methods include content analysis, formative and summative evaluation of the instructional activities, and technologies employed in a distance-learning course. The data for content analysis are based on conference transcripts from both synchronous and asynchronous communication. Formative data are based on student reflection journals, instructor's log, and observers' logs. Four observers were invited to observe the class on a weekly basis. They submitted a weekly log to the instructor to suggest improvement on the instructional design and activities for this class. The summative data are collected from the following student surveys: student background, course evaluation, CMC-skill assessment, student perceptions of communication characteristics of technology, group cohesiveness and performance. Detailed descriptions of these surveys can be found in Chou's dissertation work (2001b).

Both synchronous and asynchronous seminars were conducted on a weekly basis. In the synchronous seminar, students were responsible to take turns in moderating small group discussions. In the asynchronous seminar, students collaborated in building a knowledge base by sharing and exchanging constructive views on a topic related to CMC systems. In addition to the weekly discussion, the semester-long projects also required the students to collaborate in small groups via various CMC systems.

Bale's (1950) Interaction Process Analysis (IPA) was adapted as the basis for content analysis to describe the patterns of student interaction in small groups via both synchronous and asynchronous networks. IPA was originally developed to study small group interaction in two main areas: socioemotional -oriented and task-oriented interaction.

Research questions are divided into the following three main categories:

A. Technology Attributes

QA1: What are the technological factors that affect student interaction?

B. Learning Activities

Synchronous vs. Asynchronous discussions

QB1: Is there a significant difference in the social-emotional contents and task-oriented contents between synchronous and asynchronous communication?

Conference Moderation

QB2: Moderator vs. Participants: How can a conference moderator help to facilitate online discussions?

Small Group Collaboration

QB3: What are the student perceptions of small group collaborative activities?

C. Learner Characteristics

Prior Computer experience

QC1: Is learner's experience with computer correlated with total number of messages submitted?

Gender

QC2: Is there a significant difference in the SE-oriented vs. task-oriented contents between female and male participants?

Analysis and Discussion

Technology Attributes

Students rated each CMC system on the following communication characteristics: social presence, communication effectiveness, and communication interface. Of all systems tested, WebCT chat received the highest rating and the Palace came in second place. This is an indication that students valued reliable and smooth connection for communication. WebCT chat turned out to be the most reliable and straightforward CMC systems used. In addition, the add-on affective components (wearable-avatars, voice-activation, bubble messages, etc.) in the Palace actually made the conversation more realistic. Students demonstrated enjoyment in using the avatars to express themselves during the online conversations.

Positive technological attributes can enhance interaction and negative technological attributes can hinder interaction. Table 1 is a summary of various technological factors that affect interaction.

Table 1. Positive and Negative Technological Attributes Affecting the Degree of Interaction

Positive Features	Negative Features
A. System performance	
Fast loading, low bandwidth	Bandwidth intensive
Transcript recording	Non-recordable conversation
Good audio/video quality	Poor audio/video quality
Cross-platform compatibility	Platform-specific
B. Interface design	
User-friendly navigation tools	Nontransparent or no navigation tools
Learner centered (e.g., customizable, flexible, and scalable interface)	Program controlled (e.g., fixed and un-customizable interface)
Wearable avatars with a variety of selections	Fixed-type avatars with stereotypical selections
Low levels of distraction (e.g., good visualization of screen icons)	High-levels of distraction (e.g., lack of organization of screen icons)
Status indication (e.g., occupied, off-line, online, etc.)	Lack of status indication
Accessible to users with disabilities (e.g., Bobby-approved, text-to-speech option)	Not accessible to users with disabilities
C. Communication characteristics	
High degree of social presence	Low degree of social presence
Effective for communication at interpersonal level	Ineffective for communication at interpersonal level
Effective for communication at system level (e.g., fast message exchanges)	Ineffective for communication at system level (e.g., delayed message exchanges)
High degree of expressiveness (e.g., mood indicators)	Low degree of expressiveness
Affective communication components (e.g., optional toolbox for emoticons, props for avatars, etc)	Impersonal communication components (e.g., command-line oriented communication)
Division of public vs. private space (e.g., breakout sessions for small groups)	Lack of division of meeting rooms

Based on the observation by the instructor and evaluators, student adaptation to technology can be summarized in four stages:

- The WOW stage: At the initial phase, students were fascinated with the potential of technology and amazed at what CMC systems could have accomplished.
- The FUN stage: At the second phase, students actually used the systems for simple tasks and derived a great deal of pleasure in the hands-on experience.
- The OH-OH stage: This was the frustrating stage when more complex tasks were given and their skills had not developed enough to handle these tasks.
- The "Back-to-Normal" stage: Students either became more competent in the use of technology or became comfortable with dealing with technical difficulties. They internalized their anxiety and accepted that technical glitches were inevitable in the learning process.

Learning Activities

a. Synchronous vs. asynchronous discussion

The two main categories in Bale's IPA are social-emotional oriented interaction and task-oriented interaction. The multiple regression analysis shows that both variables significantly predict the interaction patterns in both communication modes, $F(2, 116) = 85.7$, $p < .0001$ (Table 2). The mean sentence per person in synchronous mode is 26.31 sentences and 51 sentences in asynchronous mode. Because $R = .77$ and $R^2 = 0.6$, 60% of the variance is accounted for by these independent variables. The analysis shows that there is a significantly higher amount of SE-oriented interaction in synchronous discussions and a significantly higher volume of task-oriented interaction in asynchronous discussions.

Table 2: Multiple Regression Analysis Predicting Interaction in Synchronous Versus Asynchronous Discussions

	Syn. Mean	*Syn. SD*	*Asyn.Mean*	*Asyn. SD*	*F*	
SE	8.66	8.12	4.26	4.72	-7.46	***
TASK	17.65	15.53	46.74	19.11	12.21	***
totals	26.31	22.01	51.00	20.76	5.85	***

****P* < .0001

In the synchronous communication mode, there was more spontaneous communication going back and forth. The communication processes between asking and answering questions are more equally distributed in synchronous communication, whereas in asynchronous communication, students tended to volunteer to give more information than to ask questions.

The synchronous communication mode also made it easier to provide immediate feedback to information seekers. Some students were actively engaged in discussions while other students waited until they were asked to say something. The researcher observed that there was more equal participation in the discussions in three-member small groups than in large groups. In addition, in synchronous mode, participants asked more personal questions and revealed more about their frustration or need for help with less hesitation. Personal questions such as one's occupation, schooling history, and background of technical training were included more often in synchronous discussions.

b. Conference moderation

Students took turns moderating small group discussions in the weekly synchronous seminars. Every group was responsible for hosting one online seminar in the semester. Because there were thee members in each group, the seminar was usually divided into three small groups so that each member of the host group could moderate one group in the online seminar. The moderator's action is highly correlated with the performance of the conference participants. According to Table 3, when a moderator sent out more task-oriented content, the participants also responded with more task-oriented messages, $F(1, 163) = 36.58$, $p < .0001$. Likewise, when a moderator sent out more SE-oriented content, the participants responded with messages of the same nature, $F(1, 163) = 11.91$, $p < .001$. In addition, the total number of messages sent by the moderators also contributed positively to the total number of messages sent by the participants, $F(1, 163) = 28.85$, $p < .0001$. Overall, the moderator's functions are vital to the information exchanges in a small group discussion. The comparison of the mean sentences between moderator and participant indicates that in order to encourage active discussion, the moderator usually sent out two or three times more sentences than the participant.

Table 3: One-Way ANOVA Between the Mean Sentences Sent by Moderators and Participants

	Moderators	*Participants*	*F*	
SE Mean	9.05	3.5	11.91	**
Task Mean	24.15	6.29	36.58	***
Total Mean	33.19	9.78	28.85	***

***$p < .0001$, **$p < .001$

c. Small group collaboration

Two forms of collaboration took place in small groups: synchronous seminar and project preparations. In addition to working together to host a successful synchronous seminar, members of a small group also met several times in private throughout the semester to prepare for seminar moderation and case study. Students were asked to complete the questionnaires on group cohesiveness, individual commitment, and individual performance at the end of the term. The highest score one member of a group could get was 40 points. In Table 4, the mean score of each group is listed.

Table 4 Group Performance Evaluation and Group Cohesiveness Score

Groups (n = 3)	Cohesiveness		Perceived quality of group performance	
	Mean	SD	Mean	SD
GROUP 1	39.67	0.82	5.98	0.86
GROUP 2	37.5	3.89	6.02	1.16
GROUP 3	38.5	2.07	5.94	0.97
GROUP 4	32.5	10.61	3.76	1.63
GROUP 5	37.0	4.08	5.53	1.18

The correlation between the perceived quality of group performance and group cohesiveness is significantly high, $r = .95$, $p = .01$. Group members who rated their actions highly cohesive also deemed their performance high. However, the correlation between perceived quality of group performance and individual commitment is low, $r = -.12$, $p = .29$. Individuals who were committed to their work did not necessarily consider group performance quality high (see Table 5). In some instances, members of a group might work harder when they foresaw that the quality of group performance would not be up to standards. Putting students in small groups and assigning collaborative tasks to each group does not always guarantee a successful learning experience. The summary section concludes a number of factors affecting online interaction..

Table 5 Mean Score of Individual Commitment and Perceived Quality of Group Performance

Groups (n = 3)	Perceived quality of group performance	Individual Commitment
GROUP 1	5.98	5.83
GROUP 2	6.02	6.64
GROUP 3	5.94	5.50
GROUP 4	3.76	6.13
GROUP 5	5.53	6.00

Learner Characteristics

Due to insufficient data and small sample selection, no significant correlation was found between total messages sent by each participant and their previous computer experience. In terms of gender differences, significant differences were found in synchronous mode in both SE-oriented and task-oriented interaction. In general, female participants sent out more sentences than the male participants in both synchronous and asynchronous communication modes; the female mean sentences are higher. Nevertheless, female participants sent out significantly higher number of messages in both SE-oriented and task-oriented areas. Overall, female participants consistently sent more SE-oriented messages in both communication modes.

Summary

Interaction Factors

The main conclusion drawn from this study is that the design of learner-centered online activities and the selections of appropriate technologies do contribute to different patterns of interaction. The research findings are summarized as follows:

A. Learning activities: Constructivist-based instructional activities such as student-moderated discussion and small group cooperative learning are conducive to interaction and learning. Specific findings are listed as below:

a. The appropriate use of synchronous online seminar can enhance interpersonal relationship. In general, students submit a higher percentage of task-oriented messages than social-emotional oriented messages in both asynchronous and synchronous communication modes. Nevertheless, there is a higher percentage of social-emotional interactions in synchronous mode than in asynchronous mode.

b. Asynchronous peer review provides the opportunity for collaboration on building knowledge bases and information sharing.

c. Interestingly, there was more one-way communication in asynchronous mode. In asynchronous mode, students seemed to be more interested in expressing opinions than challenging each others' views; whereas in synchronous mode, there were more questions and answers. Students were more engaging in the synchronous discussions. There was a stronger sense of immediacy to respond to peers' questions in synchronous mode than in asynchronous mode.

d. Student-moderated conference based on the SCD Model allows learners to take initiatives in their learning and be efficient in communication via various CMC systems.

e. Forming small groups for online seminars or group projects helped to reduce the initial disorientation and confusions of online learners.

B. Technology attributes: Discussion on technology attributes focuses on the mode of communication systems and the communication characteristics such as social presence, communication effectiveness, and communication effectiveness.

a. Communication systems: the selections of synchronous or asynchronous technologies contributed to the different interaction patterns. Students tended to spend much more time in task-oriented discussions in asynchronous mode. When online tasks were clearly defined and students passed the initial "get-to-know-each-other" stage, students were inclined to spend less time in SE-oriented interactions in both communication modes. Nevertheless, learners consistently spent more time in SE-oriented interaction in synchronous mode than in asynchronous mode.

b. Communication characteristics: Student ratings of a CMC system increased as the frequency of uses increased. Student perceptions of the communication characteristics of technologies might affect their initial interaction online. Time played an important role in student adoption of new technology. Usually after the first two or three weeks, students were able to ignore some of the "obstacles" of a system and concentrated on the task at hand.

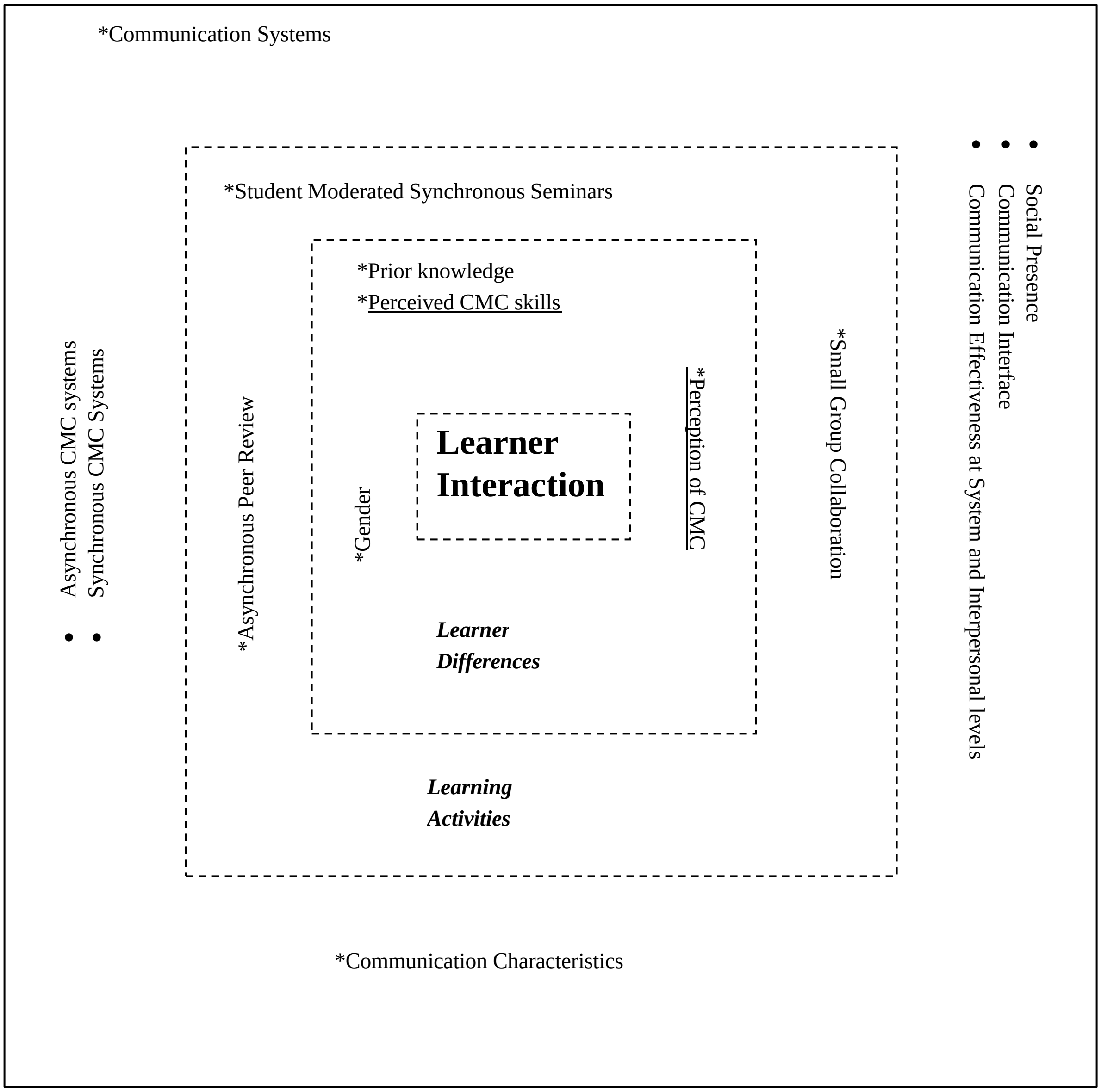
c. Learner characteristics: Gender difference affects how students interact online. Female students contributed more to SE-oriented interaction than the male students in both communication modes. In addition, prior knowledge in a subject matter and computer experience contributed to the different interaction patterns in the individuals at the beginning stage. After the first two weeks, the difference was hardly noticeable.

As the result of the research, a model of Learner-Centered Computer-Mediated Interaction for Collaborative Distance Learning is proposed to explain factors that could affect interaction as shown in Figure 1.

Conclusions

Research in distance education covers a wide spectrum of issues. Although interaction is not the only key to successful distance education, this factor is vital to the progress of learners, teachers, and the school as a whole. As Gunawardena et al. (1997) has boldly put it: "No interaction, no education." This research emphasizes the importance of interaction research by providing supporting evidence in activity design, technology employed, and learner differences. This study advocates the integration of learner-centered instructional design and constructivism into the curriculum. The researcher hopes to break the myth that synchronous communication is impossible to manage. On the contrary, as shown in this study, the appropriate incorporation of synchronous activities can enhance learning interests and interpersonal relationship. Although there is no lack of research in distance education since the 1980s, there is a need for more research on emerging technology employed in distance education because the implications and applications also affect educational policy and management. This study is a small contribution to the understanding of the ever-changing technological ecology of distance education.

Figure 1: Model of Learner-Centered Computer-Mediated Interaction for Collaborative Learning



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Web Enhanced Learning and Student Awareness of Strategy Use

Jane Crozier

Abstract

This qualitative study examined the awareness of strategy use and justification of that use of gifted undergraduate students as they researched, utilized resources, and evaluated finalist for a global understanding and peace award. The participants in the informal learning environment utilized a web-based learning environment. Their homepage was developed in WebCT and allowed them to access to informational resources, conduct online chats, and write reflective journals. The findings focused on the student awareness of their strategy use and their online learning community experience.

Introduction

An increasing number of universities and K-12 school systems are using some type of web-based support for learning (Mandiach & Cline, 2000). Mandiach and Cline (2000) argue that despite the enthusiasm of some educational institutions, practical and curricular problems related to the integration of web-based learning environments persist. These environments range from low-level integration where a homepage contains links to related information; to mid-level integration, where a homepage contains informational links, asynchronous and/or synchronous communication connections in the form of chat sessions or a bulletin board, and course handouts; to a high-level integration, where the entire course is delivered via the homepage including lectures, homework, all communications, testing, and student grades (Miller & Miller, 2000).

Researchers have just begun to scratch the surface of the usefulness of the range of different levels of web-based learning environments (Gunawardena & Zittle, 1997; Miller & Miller, 2000; Palloff & Pratt, 1999). The research highlighted the online learning communities involved in various levels of web-based environments and learner characteristics that enable students to successfully interact and learn using these environments. These elements were identified through exploration of either reflection or collaboration, and from the perspective of the teacher and/or student.

Purpose

This study continues the research into web-based learning by examining a mid-level web-based learning environment as a support for an informal learning experience. The informal learning situation was a group of undergraduate students, that were Fellows in the Honors program, who served as the selection committee for the finalists of a global awareness and peace award. The committee members needed to determine the award criteria, research and learn about the backgrounds and attributes of each nominee, and evaluate each nominee based on the criteria for the award. There were a variety of strategies the students would utilize in order to develop criteria, research nominees, and evaluate nominee attributes. The learning aspect explored was the role the web-based environment had in supporting student awareness of strategy use.

Online reflection and collaboration activities to identify strategy were used and the reasoning behind that use, from the student perspective. In addition, perceptions of the student's online experience were sought. The original research question addressed in this study was, "How does a web enhanced learning environment effect the nomination process?"

Research Literature

Awareness of strategy use

Researchers in the field of psychology consider "awareness of strategy use" as part of an individual's metacognitive abilities. Bjorklund (1995) and Sternberg (1990) identify these abilities as an individual's knowledge and regulation of cognitive processes. The knowledge of an individual's cognitive processes or strategies involves knowing the proper time to use strategies and the reasoning behind their use. The regulation of cognitive processes or strategy use involves planning strategy use and evaluation of the result of the strategy usage, although mentioned here as a definition, regulation is not a focus in this study.

The research on strategy use and the reasoning behind that usage, the focus of exploration for this paper; involves strategy use in problem solving (Royer, et al, 1993) and among gifted students (Carr, et al, 1995). Strategy usage has been easy for students to identify, however the reasoning behind strategy use is more difficult for individuals to identify. The findings dealing with knowing when to use a strategy have indicated that it is fairly easy for adults to identify strategies they have used; however younger learners cannot always identify a strategy by name (1995). In both cases, discussing their reasons for strategy use was much more difficult, if not impossible.

Online student reflection

The research conducted involves student reflection activities, and usually revolves around student impressions of learning and working in an online learning community (Sherry, et al, 1998; Gunawardena & Zittle, 1997). However, one study of particular interest was that of Guzdial and Turns (2000); where they examined student reflective practice in an online community as the students collaborated on projects in an online engineering course at the University of Michigan. According to the findings, in order for the students to successfully contribute to their class, they had to reflect on the bulletin board discussion threads and determine whether a new or alternative idea should be contributed to the concept thread and how their response would be perceived. These practices assisted in student contribution to course discussion threads and, the researchers noted, in turn, enhanced student learning.

Online student collaboration

The research involving web-based learning support of student collaboration focused on providing students with immediate access to their peers and to informational resources on the Internet (Palloff & Pratt, 1999; Sherry, et al, 1998). Through collaboration, many students form online learning communities within the bounds of the course or project. Palloff and Pratt (1999) emphasize that these communities have a great influence on the success of the class; in fact, these researchers suggest that if the community is unsuccessful or does not exist then no learning occurs.

The strength of the collaboration is key to the success of the community and is dependent upon the student's comfort level as a member of the community. Sherry, et al (1998) discussed that participants in their study had stronger communities when the members had a high comfort level while working in the online environment. An element that enhances a member's feeling of comfort is what Gunawardena and Zittle (1997) called a "sense of presence." According to these researchers, this sense of presence indicates that the member feels a strong connection to the online community. In addition, it has been identified as a key factor in successful online learning experiences.

Method

Participants

The participants involved in this study were nine Honors Fellowship undergraduate students at a public university. Students who received a fellowship are viewed as gifted. These Honors Fellows served as members of a selection committee responsible for selecting the finalists for an annual global understanding and peace award. One third of the committee had participated the previous year. The names used in the study were pseudonyms selected by the participants. There were two teams. The advisor to the this student committee was also the researcher.

Study Design

This study took place in the informal educational setting of the award selection committee for approximately two and a half months. The participants worked individually to research their nominee (included individuals and nonprofit organizations involved with issues related to global understanding and peace initiatives) and in teams to support each other's efforts. The first two committee meetings were designed to orient the students to research resources, establish evaluation criteria for the nominees, and allow the students to select their nominee.

In the following month, the teams met weekly to discuss member research progress and evaluation issues. These weekly meetings were held in the team chat rooms. The final team meeting was held face-to-face. Each team member introduced his/her nominee and answered questions posed by other team members. At the end of the meeting, the team members selected one or two nominees to submit to the full committee as finalists. The team members who nominated the team finalists incorporated the feedback from other team members into a one page composite listing of the nominee's background and attributes for submission to the full committee. The full committee reconvened after the final team meetings and nominated the finalists.

During the final two meetings, in the first full committee meeting, each team introduced their nominee to the group, in a similar manner as they did during the final weekly team meeting. The full committee then voted on the nominees from the teams and selected all the nominees submitted, six in all. The finalist composites submitted to the full committee were expanded into nomination documents. These documents detailed the nominee's background, affiliated organization, and criteria based attributes; and were then sent to the governing board.

Homepage Design

The committee web page was developed in WebCT (an Internet based course support system which supports asynchronous and synchronous communication such as Chats and bulletin boards, as well as student records, faculty lectures and notes via audio and/or video). The homepage provided the group with secure access to: 1) Weekly meeting schedules and updates, 2) team chat rooms, 3) reflective journals via bulletin board, 4) forms to support research, and 5) links to research databases. These resources provided a convenient and effective means for feedback among the team members and the advisor. After the weekly chat meetings, students were asked to reflect on the process they used and their online experience, in their individual online journals (shared only with the advisor, not the other students). The students used forms on the Homepage that served as guidelines for recording sources. The students provided research database links that grew in number as they located more sources of information. The links were made available to all committee members in order to help those having problems locating resources.

Data Collection

The study's data collection resources were triangulated to trace student strategy use, depict student awareness of strategy use and its justification, as well as provide confirmation of findings. This triangulation of data resources was utilized to provide greater validation to the study (Patton, 1990).

- Weekly Team Chat Session Discourse: The chat session discourse was recorded and reviewed in search of evidence of criteria and evaluation strategy discussions. The reflective journals were included as a main source of data related to student awareness of evaluative strategy use.
- Student Reflective Journals: Each week, the students were asked to respond to a few brief questions and incorporate their own thoughts and ideas, about the process, and their research, into their own reflective journal.
- Semi-formal Interviews: The interviews of team leaders/facilitators were conducted half way through the project. These individuals were selected because they facilitated the chat discussions and their role focused on review of team progress. They presented opportunities for obtaining data related to student awareness (Patton, 1990). Most of the student questions focused on the criteria selection process, research, and the online experience.
- Participant Observer Fieldnotes: Since the researcher (myself) was also the advisor to the group, participant observer fieldnotes were used. These notes were summaries of events during the face-to-face meetings.
- Student Artifacts: The student artifacts or final nominee documents were used to review the synthesis of the team's work and the progression of evaluative strategy use.

Data Analysis

The qualitative case study method was used (Glaser, 1995; Merriam, 1997) to analyze the data collected in this study. The case study method incorporates constant comparison for the analysis. During the analysis, the researcher reviewed the data, identified patterns, determined categories, and identified overriding themes. The student reflections, chat discourse, and final documents were compared to identify repetitive themes related to awareness of strategy use and online learning. The field notes and artifacts were used to verify findings. The credibility of the study analysis was enhanced through an exhaustive search for negative cases found in the themes. According to Merriam (1998), a negative case is one that is the extreme opposite of the patterns or trends discovered during analysis. These cases were sought to extend the definition of the rule of the pattern, as in participant awareness of strategy use or participant experience as an online learner (Patton, 1990; Merriam, 1998).

Key Findings

The students began their discussion to establish the criteria used in evaluating nominee goals and accomplishments; the group discussion required an additional group meeting in order to determine the final criteria. After this first meeting, the participants selected their nominee (there were fifteen nominees and nine students, so six students selected two) and began their research. At the end of the second meeting, the criteria was established. The students developed a list of five criteria: Awareness, Benevolence, Commitment, Diplomacy, and Influence. The presence of the criteria served as a foundation for the students and was mentioned periodically during team meetings as reference points from which to gauge the information they were reviewing. The criteria guided their research, discussions, and decision-making. The responses to the interview questions, guided reflection, and chat discussions provided a comprehensive picture of the student strategy use and their online experience. Two key questions asked were, "What steps did you take to determine the criteria?" and "Why did you make your selection?"

Awareness of Strategy Use

The students were able to identify the strategies they used to establish the criteria, such as brainstorming, adaptation, compare and contrast, and simplification. However, most did not adequately discuss their reasons justifying their choices. One student, Madi, from Team A, demonstrated this when she discussed her strategy selection during her participation in the first round of criteria development:

> I just basically brainstormed ... And then in my group, Don and Jan, they had really specific things, like "have an extended period of service" … – mine are a little vague so I adapted mine to the more specific things that they had.

Madi's awareness of her use of the brainstorming and adaptation strategies were present, however her reasoning for discarding her original criteria list and adopting the list of her teammates seemed weak. Madi adopted the new list, citing that it was more specific than her list, but did not expand on why she found this attribute preferable. This awareness of strategy use and lack of reasoning was apparent in the reflections of most of the participants. The ability has been noted in gifted students by Carr, et al (1995); their findings indicated that gifted students more so than average students possess specific strategy knowledge or the metacognitive knowledge about when and where to use a strategy with fewer of the students knowing why they used a strategy.

The students in this study, indicated that they knew when and where to use a strategy, however, only one expressed exactly why she used a specific strategy. Another student, able to identify the strategies she used, was also able to discuss her reason for using the strategy. This unusual illumination occurred with one participant, a case which further defines the strategy usage theme to allow for some rare occasions when gifted students are able to justify their use of a strategy. Radison, from Team B, commented on her own strategy use and reasoning, when she discussed the hour of debate that ensued prior to the acceptance of the final criteria list. This debate was a war of words rather than meaning; the paragraph length descriptions of each attribute was eventually reduced to the five general terms representing global understanding and peace at Radison's Team's prompting (The five criteria for global understanding and peace were: Awareness, Benevolence, Commitment, Diplomacy, and Influence). Radison wrote in her journal:

> We came up with five words that seemed to cover the overall theme we had been trying to get at in all the previous work. I think simplifying is often the most overlooked step in processes such as these. Sometimes it's hard to take ideas off the list because it feels like we're moving backwards.

Radison recognized that the strategy the group was using to finalize the criteria (refining the phrases, word by word) was not working and suggested another way of accomplishing the task. This way was accepted almost immediately.

Online Learners

Online community:

The chat sessions, participant observer field notes of face-to-face meetings, and interview responses from the two team leaders relayed information regarding student roles and impressions of the online chat meetings. The patterns that emerged depicted themes of the nature of online collaboration that focused on member support and interaction in the online community. Each member had a role, i.e. facilitator, support member, or advisor; most of these roles were identified in Palloff's and Pratt's work (1999). In a supportive function, team members voluntarily offered information resources, research tactics, and emotional support for those frustrated with either an over abundance or lack of informational resources. These aforementioned practices demonstrate a camaraderie among team members that appears to have strengthened throughout the committee's tenure. The teammates joked with and teased each other.

However, the establishment of the online community could not be solely attributed to the participants' involvement in the chat sessions. Since many of the students knew each other prior to their involvement in the committee, due to their honors fellowship affiliation; the camaraderie among Team B community members, while strengthened by the online interaction, was also a product of the prior affiliation and the face-to-face meetings (Palloff & Pratt, 1999; Gunawardena & Zittle, 1997).

The students preferred interaction among their peers, indicating a greater satisfaction and comfort level, than from their online interactions. While the facilitated discussions and online chats provided team members with a convenient opportunity to give and obtain the additional skills they needed to access additional information about their nominees and support better decision making; the chat environment didn't offer the personal interaction the team members were accustomed to and preferred. The students stated that they felt the online meetings were convenient and productive; however, since they were on the same campus, their preference was for face-to-face meetings (Sherry, Fulford, and Zhang (1998). The team mentioned that they would work in the online environment again, but only out of convenience (1998). Overall, the team members impressions of their online experiences were productive and facilitated their research, but less satisfying than their face-to-face interactions.

Lack of social presence:

The students indicated that the online experience just wasn't the same as meeting in person. They exhibited some resistance to the use of online means of communication by requesting that they have another face-to-face meeting instead of a final chat session. This resistance could have hindered their online experience, but was not the only deterrent to their online experience. The students mentioned that technical problems, such as delays in response time and disconnections, made for a less than optimal experience; and due to typing delays, the chats were sometimes difficult to contribute to and follow.

Online behavior:

As mentioned in the Online Community section, much of the online behavior observed supported past research that identified members of the community assuming and maintaining their roles in the community (Palloff & Pratt, 1999). One role, of particular interest during the team chat sessions, was the that of the chat facilitator. The facilitator was voted in by the team to be the team leader and facilitate the chat meetings. The unexpected online strategies used by the chat facilitator were monitoring and troubleshooting the chat session. These were used to maintain continuity during the discussion and ease any discomfort among chat participants,. This practice moved team members through awkward moments and is illustrated by TLeader, from Team B, after a few minutes of silence and an interruption in the chat:

TLeader:	this may be an awkward silence, so i'll move on. Nimbus, how's your research going?
Nimbus:	Do they focus on promoting peace between certain religions or do they have broader goals of general tolerance/acceptance?

During later reflection she indicated that it was difficult to determine why chat participants stopped interacting (typing).

> Somebody could have been typing, somebody could have been thinking, somebody could have been preparing a response, but nobody really knows so you are just sort of sitting there wondering well should I break the awkward silence.

TLeader monitored and effectively smoothed over the rough spots during the online chat. When she encountered a difficulty or interruption in the communication line, she mentioned it and moved on. This practice seemed to assuage some team members discomfort in the online environment. Madi, chat facilitator for Team A, did not specifically address the silences; she simply moved on quickly through the session. This practice could have affected her team interaction; they did not have a great deal of camaraderie.

Recommendations for Practice

- Online monitoring and troubleshooting strategies of chat facilitators can improve comfort level and promote community during chat sessions. Acknowledging awkward moments, such as silences, inactivity or technical difficulties and quickly move forward may improve comfort level and promote community among group members.
- In the online learning community, to maintain student interest and increase student comfort, create a sense of presence for the students, by the use of humorous emoticons ☺, self-selected avatars, or other methods to improve a student's online experience.
- Guided reflection may encourage student awareness of strategy use for evaluation purposes and online community facilitation.

Conclusion

This study has laid the groundwork for future research in online learning communities through the examination of online strategy use of chat facilitators. The findings here encourage further analysis of successful facilitative strategies for chat sessions in order to provide continuity in communication, enhance member comfort, ensure the productivity of the group, and facilitate the learning process.

In addition, the findings of this study support those of other researchers in the area of metacognition or awareness of strategy use among gifted students. Specifically, the participants in the study were able to identify their strategy use during criteria development and all but one experienced greater difficulty identifying their reasons for using a particular strategy.

Furthermore, the findings support previous research on successful online learning communities, especially in the importance placed on student comfort level and having a sense of presence in the online environment.

Finally, this study offers additional insights on web-based learning, such as facilitation of online communities and reflective practices, leaving the essence of successful web-based learning less of a mystery.

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Authoring Tools and Learning Systems: A Historical Perspective

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Abstract

Authoring tools have evolved over the last decade based on technological and pedagogical innovations, from authoring bounded, program-controlled learning systems such as Computer-Based Instruction (CBI) to authoring unbounded, learner-centered environments such as Web-Based Instruction (WBI). This paper discusses the current and future state of authoring tools and their pedagogical effect on the development of learning systems. It provides a taxonomy of authoring tools and their underlying paradigms; a detailed table that compares and contrasts pedagogical attributes of CBI and WBI; and it discusses two innovative approaches on how future authoring tools can preserve the level of usability and the instructional methods that instructional designers have become familiar with while allowing more powerful and flexible learning systems to be built.

What are authoring tools?

Authoring tools are software tools that enable instructional designers, educators, teachers and learners to design interactive multimedia and hypermedia learning environments without the knowledge of programming languages. "The premise behind authoring tools is the absence of a programmer or the ability of designers with little or no programming experience to develop and design instructional applications" (Hedberg & Harper, 1998). For example, multimedia authoring tools facilitate the development of Computer-Based Instruction (CBI) by masking the programming layer, and Web-based authoring tools facilitate the development of Web-Based Instruction (WBI) by masking the HTML scripting layer (Craney, 1996). In essence authoring tools are an accelerated application or simplified form of programming by virtue of their inclusion of pre-programmed elements for the development of interactive multimedia and the deployment of a point and click user interface to activate these elements. Authoring tools however accomplish their tasks using a certain methodology or paradigm that requires a type of heuristic or algorithmic thinking similar to that of programming languages (Siglar, 1999). Some of these paradigms include the scripting metaphor, the card-scripting metaphor, iconic/flow control, hypermedia linkage, the frame metaphor, the cast-score metaphor, the hierarchical object metaphor, and tagging (Kozel, 1997; Siglar, 1999). Table 1 provides a brief explanation of these heuristic paradigms and examples of authoring tools that utilize these paradigms.

Table 1 – Authoring Paradigms

Authoring Paradigm	Explanation of paradigm	Examples of Authoring Tools
Scripting metaphor	Resembles a programming language in that it involves specifying all media elements by filename and interactions by coding	TenCORE Language Authoring System
Card/scripting metaphor	Uses an index-card structure or a book metaphor to link elements	Hypercard, Supercard, HyperStudio, TenCore, Toolbook II
Iconic/flow control	Uses icons to represent interactions and links them sequentially in a flow line that depicts the actual result	CourseBuilder, Authorware, IconAuthor, Authorware Attain
Frame metaphor	Uses icons to specify interactions and links them conceptually providing a structural flow	StorySpace, Digital Chisel, Astound, Quest, Multimedia Fusion
Hierarchical object metaphor	Uses an object metaphor like Object Oriented Programming which is visually represented by embedded objects and iconic properties	Dazzler Deluxe, Docent, Metropolis, MediaSweets, Toolbook II Instructor, Quest Net +, Oracle's Media Objects
Hypermedia linkage	Uses a hypermedia navigation metaphor to link elements	FrontPage, Dreamweaver, Homesite, Claris HomePage
Tagging	Uses tags in text files to link pages, provide interactivity and integrate multimedia elements	SGML, HTML, VRML, 3DML
Cast-score metaphor	Uses horizontal tracks and vertical columns to synchronize media events in a time-based fashion	Director, Flash, Javascript, Java

Authoring paradigms can be thought of as organizational structures that facilitate the design of instructional materials and learning activities. Depending on the paradigm used by a specific authoring tool, the design approach, development time, instructional capabilities, and learning curve (ease of use), could vary widely from one authoring tool to the next. Hedberg and Harper (1998) emphasize this point by stating that: "The organizing metaphor of the authoring system has become critical to the effective design of the final learning environment" (p. 1). Kasowitz (1998) however insists that the value of an authoring tool is measured by how well it can support a particular designer's task regardless of its strength or approach. In order to understand how authoring tools impact a designer's task, it is important to look at the evolution of authoring tools from a technological and pedagogical perspective.

Evolution of Authoring Tools

Authoring tools have evolved over the last decade based on technological and pedagogical innovations from authoring bounded, program-controlled learning systems such as Computer-Based Instruction (CBI), to authoring unbounded, learner-centered environments such as Web-Based Instruction (WBI). From a technological perspective, the Internet has revolutionized teacher-to-learner and learner-to-learner communication by making these interactions time and place independent through the use of email, discussion boards, and other Internet-based technologies that facilitate asynchronous learning and information delivery. Web-based course management tools now include such features and components under an integrated structure. The World Wide Web (WWW) has also dramatically altered the concept of hypermedia, which is a crucial attribute of an authoring tool's interface. Hypermedia has evolved from a predetermined finite internal linking structure contained within the boundaries of a learning system to an infinite external linking structure that knows no boundaries. The WWW has also changed the nature of instructional content and resources from a well-defined and stable knowledge base to an unfiltered and dynamic information base. CDROM-based authoring tools for example have commonly relied on stable content to organize and structure instruction, which is why the resulting learning system is bounded and program-centered. Alternatively, Web-based course management tools now include features and components that allow instructors and learners to modify content and contribute resources resulting in flexible and active information structures.

From a pedagogical perspective, this means more flexibility in the design of WBI. Depending on how the tools' features are used in a course by the instructor and the learners, the "pedagogical philosophy" underlying the teaching and learning process can range from a strict instructivist approach to a radical constructivist approach (Reeves & Reeves, 1997). A strict instructivist approach typically results in a Web-based course that has a tutorial structure in which the content is organized by the instructor and *delivered* or imparted to the students; and a radical constructivist approach typically results in a more learner-centered pedagogy where students use Web features as tools to construct their own knowledge representations by restructuring content and creating and contributing their own resources to the course structure (Bannan & Milheim, 1997; Reeves & Reeves, 1997). It is more likely therefore that courses initially designed for traditional learning environments and later transformed to a Web-based format using a Web-based course management tool will undergo a *pedagogical reengineering* that is more constructivist in nature (Dabbagh & Schmitt, 1998). The presence of Internet-based communication tools, collaborative tools, and Web publishing tools in Web-based course management authoring systems make such pedagogical implications possible.

Instructional Products of Authoring Tools

The nature of instructional products has also evolved with advances in authoring tools. Interactivity as an instructional variable can no longer be "trivialized to simple menu selection, clickable objects, or linear sequencing" as is the case with most program-controlled CBI (Sims, 1995). Ambron & Hooper (1988) describe interactivity as "a state in which users are able to browse, annotate, link and elaborate within a rich non-linear database" (cited in Sims, 1995, p. 1). Web-based course management tools include note-taking tools, Web development tools, self-assessment tools, communication tools and collaborative tools for learners, encouraging a continuous dialogue between the user and the courseware such that the learner is productively and continuously active (Jonassen, 1988). This dialogical view of interactivity seems to align with a learning strategies perspective where learners are using technological tools as cognitive tools to generate their own learning (Sims, 1995). For example, with the inclusion of learner tools in authoring systems, learning environments are becoming increasingly student-centered. Learners can create and organize information in a meaningful way and take responsibility for their own learning.

Another variable that has greatly influenced instructional products developed with authoring tools is the ease with which collaborative activities can be facilitated with Internet-based technologies embedded in Web-based course management tools. The focus shifts from interaction with an instructional program to human interaction in the context of group activities. With user-specific tools, connectivity, and greater ease of use, opportunities for goal-oriented projects by teaming students to work on creating Web based projects can be truly maximized.

CBI and WBI: Instructional Attributes

In order to better understand the evolution of authoring tools from a pedagogical perspective it is important to compare the instructional attributes of Computer-Based Instruction (CBI) and Web-Based Instruction (WBI) since these are the two primary instructional or 'courseware' products generated through the use of authoring tools, with the understanding that CBI utilizes CDROM (or non-Web-based) technology to deliver its courseware, and WBI utilizes Internet (or Web-based) technologies. The type of delivery medium has played an important role in determining what instructional designs are possible. As Clark and Lyons (1999) state: "The lesson that we have learned over decades of technological evolution is that each new medium provides instructional capabilities that are unique. And each medium demands a new approach to exploit its capabilities for promoting learning." Table 2 compares and contrasts pedagogical attributes of CBI and WBI on instructional approaches, content features, instructional activities, scope of interaction, feedback, and evaluation.

Table 2 – Instructional Attributes of CBI and WBI

CBI – Instructional attributes	WBI – Instructional attributes
Lends itself to a program-centered or instructivist approach due to the closed-system nature of the courseware, hence the need to predetermine the instructional content and instructional interventions (automated delivery)	Lends itself to a student-centered or constructivist approach due to the open-system nature of the courseware, hence the potential of dynamically altering the instructional content and instructional interventions
Content is fixed, has an inherent structure and remains generally stable no matter when it is accessed by a user	Content is dynamic, instructors and learners can contribute new knowledge and add new resources to the course content
Instructional sequence and learning contexts are externally driven by objectives and tasks	Instructional sequence and learning contexts can be internally driven by learners
Restricted to references and resources embedded in product (browsing is limited to the particular CDROM)	Links to a multitude of Web sites can be readily embedded (browsing is [un] limited to the WWW)
Focus is generally on creating sequential media such as print, audio and video	Focus is shifting from media delivery tools to communication tools
Instant feedback is available through programmed interactions but less potential for personal or meaningful feedback	Learner-to-learner and instructor-to-learner interaction options providing meaningful peer and instructor feedback
Limited interaction with other learners and instructor	Unlimited interaction with other learners and instructor
Instructional activities typicaly consist of drill and practice exercises, trial and error learning or simulations with accelerated rounds of skill practice	Instructional activities generally consist of browsing links, searching online databases, posting using threaded-discussions and email, Web publishing
Testing of learner outcomes generally involves pre-tests, posttests, and multiple-choice questions	Testing of learner outcomes generally involves assessing communication skills, Web-based projects, organization of information and synthesis of content
Lends itself to criterion-referenced assessment	Lends itself to authentic assessment (peer evaluations, multiple assessors, and multiple forms of assessment)

A noticable shift from directed to open-ended hypermedia learning environments can be detected in the instructional attributes listed above. According to Hannafin, Hill & Land (1997), directed learning environments use "structured algorithmic approaches to convey a discrete identifiable body of knowledge" and "learning is externally driven via explicit activities and practice." Directed learning environments can also be described as bounded (well-defined), happening in real time, instructor (or program) controlled, and relying on stable information resources (Chambers, 1997). The instructional attributes for CBI listed above certainly fit these criteria. Open-ended learning environments (OELE) on the other hand emphasize generative learning, authentic contexts, and guided discovery approaches where learners take responsibility of learning and evaluate their own needs (Hannafin et al., 1997). Additionally, in OELEs metacognitive abilities take precedence over mastering content and asynchronous communication is paramount in supporting learning tasks. WBI however can still result in a directed approach if the inherent features of the Web are not effectively utilized by all participants in the learning environment. For example, it is possible to design a Web-based course that is self-contained and requiring minimal instructor intervention and interaction with other learners. Practice and feedback activities can be embedded in a Web-based course much like they would be in a CBI course and learners can proceed through linearly-sequenced tutorial-like content presentations at their own pace, resulting in a program-centered learning environment. Caution must be exercised to insure that WBI is not just CBI delivered over the Web.

Classes of Authoring Tools

Authoring tools can be grouped using several variables e.g. type of author/adopter (e.g. corporate developer versus teacher educator), type of delivery medium (e.g. CDROM versus Internet), type of operating system (Windows versus Macintosh), type of scripting metaphor, cost, ease of use, range of user base (e.g. learners, instructors, developers), level of technical support, type of interface, market share, media capabilities, instructional design capabilities, etc. In this paper, authoring tools are grouped by the type of delivery medium (CDROM versus Web-based), and the type of instruction produced relative to the specific features of the delivery medium (CBI versus WBI). The reason for this grouping is based on two principles. First, that the effectiveness of an authoring tool can best be measured by examining the types of instructional and learning strategies it supports (Dabbagh, Bannan-Ritland, & Silc, 2001); and second, that to date, authoring tools have been primarily used to develop two types of instruction: Computer Based Instruction (CBI) and Web-Based Instruction (WBI).

Although most authoring tools designed to deliver instruction on a CDROM have Web delivery capabilities (Internet "play" capabilities through the use of plug-ins), those tools were not originally designed to take advantage of the inherent and unique features of the Web such as connectivity, asynchronous communication, global accessibility, and ubiquitous use. Based on this fundamental distinction we classify authoring tools into two main categories: CDROM-based and Web-based. Examples of CDROM-based authoring tools are Hypercard, Authorware, and Toolbook. Examples of Web-based authoring tools are Macromedia's Dreamweaver, Claris HomePage, and Microsoft's FrontPage. Figure 1 provides a visual of these two classes of authoring tools and some distinguishing characteristics of each.

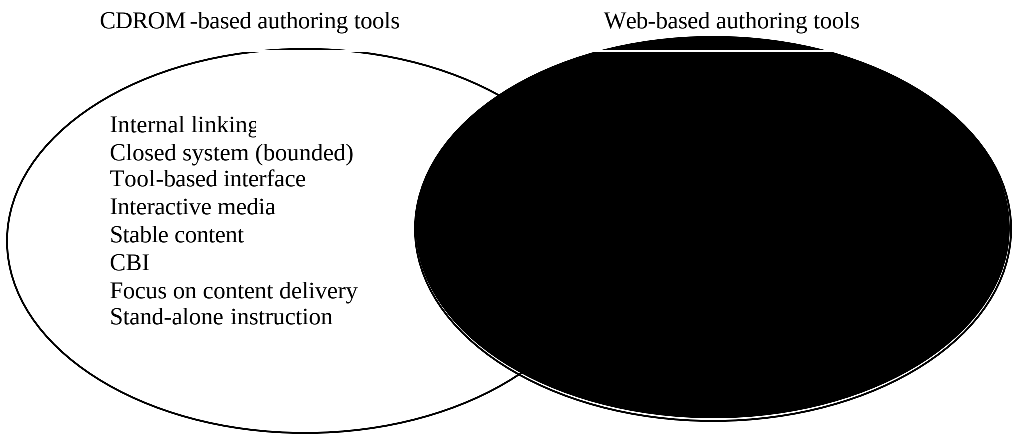

Figure 1 – Classes of Authoring Tools

Web-Based Course Management Tools

Another class of Web-based authoring tools known as Web-based course management tools emerged when Web-based authoring tools were being increasingly used to create Web-based courses for online learning. The need for a more integrative structure to manage the delivery of such courses and facilitate the migration from face-to-face classroom instruction to WBI, resulted in the development of "one stop one shop" applications such as WebCt and Blackboard. Unlike previous Web-based authoring tools, those tools include instructor tools, learner tools, and technical administration tools allowing for different types of users, and for multiple Internet-based activities embedded within the tool itself. Table 3 lists the three classes of authoring tools identified above and the general features of each.

Table 3 – Features of Authoring Tools

Category	General Features	Instructional Products
CDROM-based Authoring Tools Examples include: Hypercard, Authorware, Toolbook II, Director	• Tool-based interface • Utilized with CDROM and videodisc technologies • Closed system (does not allow user to go beyond the boundaries of what's there) • Content is generally stable • Most linking is internal, could have external links requiring firing up a browser • Can be Internet-enabled through "plug-ins" • Require installation therefore operating system dependent • Require a steep learning curve in order to take full advantage of their features • Used mostly by developers	• Computer-Based or Computer-Assisted Instruction (CBI/CAI) • Simulations • Games • Microworlds • Tutorials • Individualized instruction • Programmed Instruction • Self-contained interactive modules • Mastery learning • "Canned" or stand-alone instructional products • Standard testing programs (e.g. SAT) • Criterion-based testing

	and instructional designers to produce instructional software • Do not have specific instructor or learner tools (only developer tools)	
Web-based Authoring Tools Examples include: FrontPage, DreamWeaver, Claris Homepage, Homesite	• Browser interface • Utilized with Internet-Based technologies • Open system (allows user to go beyond the boundaries through external linking to the WWW) • Extensible • Dynamic content • Enables active/collaborative media • Require a steep learning curve in order to take full advantage of their features • Used by a variety of users to develop Web sites for multiple purposes • Do not have specific instructor or learner tools	• Single Web pages and integrated Web sites for the purposes of information presentation to support classroom instruction • Structured Web sites resulting in a variety of formats for WBI • Personal and institutional homepages • Web publishing • Organization of Web-based resources • Complex animations and interactions when used with high level scripting languages (Java, Javascript, C++) and other Web development tools
Web-based Course Management Tools Examples include: WebCt, Blackboard, TopClass, Virtual-U, LearningSpace	• Browser interface • Utilized with Internet-Based technologies • Open system • Easy to use • Dynamic content • Enables active/collaborative media • Have specific tools for instructors, learners and administrators • Embedded communication tools (email, discussion forums, group tools) • Used primarily to manage and deliver online learning in educational institutions and online training in corporate settings	• Distance education programs • Courseware (WBI) • Knowledge networks • Asynchronous & synchronous learning environments • Distributed learning environments

Scalability and Usability

It is evident from the table above that authoring tools have evolved on three fronts: networkability, level of use (user-base), and ease of use. CDROM-based authoring tools were primarily designed for software developers and became popular mechanisms for supporting the production of CBI where learners interact with an instructional program to gain mastery of a certain skill or knowledge (Kasowitz, 1998). The World Wide Web (WWW) shifted the focus of interactivity from interaction with an instructional program to interaction with other learners (global interaction) (Kearsley & Shneiderman, 1998), and from accessing materials on bounded delivery vehicles such as CDROMs to accessing unbounded and dynamic information through a network of global resources on the Web itself (Clark & Lyons, 1999; Hedberg, Brown, & Arrighi, 1997).

The WWW also created the need for tools to develop Web pages which began with simple text editors to create HTML files and evolved to Web-based authoring tools which continued to grow in functionality integrating more user features and Internet-based technologies leading to the development of Web-based course management tools. The learning curve dropped sharply with Web-based course management tools as the interface became more template-controlled ("choose-it-and-we'll-do-it-for-you") and the functions more context sensitive, extending the user-base to multiple user profiles. With little or no prior experience in authoring, instructors, learners, university administrators, and corporate developers are all able to easily explore the potential of these integrated tools to create, engage-in, manage, and deliver online learning.

Current Authoring Tools

Authoring tools can be traced back to the 1960s when "computer-assisted instruction was viewed as an economically viable way to distribute teaching expertise" (Huntley & Alessi, 1987, p. 259). In 1997, Kozel documented about 50 commercial multimedia authoring tools not counting highly specialized niche tools. Most of the market's share was spread among the most popular tools: Aimtech's IconAuthor, Allegiant's Supercard, Allen Communication's Quest, Asymetrix Toolbook II line (Asymetrix is now Click2Learn), Macromedia's Director and Authorware, and mFactory's newer object-oriented metropolis. Currently, Macromedia claims to own 80% of the authoring market between their two tools, with Director possibly dominating this market share. Other tools with a loyal following include: Claris' Hypercard, Oracle's Media Objects, Apple's MediaTool, and Discovery Systems CourseBuilder.

In a survey on the usage of Web authoring tools on the Web conducted by Security Space in July of 2000, the following WYSIWIG (What You See Is What You Get) tools were listed in descending order of percentage use: Microsoft's FrontPage, Netscape's Composer, Adobe Page Mill, NetObjects Fusion, HotMetal Pro, IBM HomePage Builder, NetObjects Authoring, Macromedia's Dreamweaver, Allaire's Home Site, and IBM NetObjects TopPage However when taking the mind-set of a professional Web developer responsible for a medium-sized company's Web efforts, Oliver Rist of InternetWeek (1998) selected three WYSIWIG Web authoring tools that are powerful enough to develop cutting-edge pages, yet visual enough to do so quickly and easily. The three tools were Microsoft's FrontPage, Adobe's Page Mill, and Macromedia's Dreamweaver, with FrontPage coming out on top in terms of an "all-in-one professional-level design and management tool", and Page Mill and Dreamweaver following closely behind. In a more recent roundup of Web-based authoring tools, PC magazine in its May 4th, 2000 issue gave Dreamweaver first place for advanced site design with an average user rating of 9/10, and FrontPage first place for basic site design with an average user rating of 7/10. Allaire's Home Site received an honorable mention in the same issue and was highly recommended for developers who prefer complete control over their HTML code due to its thorough code-editing capabilities.

Web-based course management tools (WBCMT) represent yet another share of the market which clearly lies in the education sector since the main purpose of these tools is to facilitate the management and delivery of online courses to support e-Learning and distance education programs. In a recent survey by the U.S. Department of Education's National Center for Educational Statistics (NCES), it was reported that the number of distance education programs increased by 72 percent from 1994-95 to 1997-98 and that an additional 20 percent of the institutions surveyed plan to establish distance education programs within the next three years (The Institute for Higher Education Policy, 2000). It was also reported that 1.6 million students were enrolled in distance education courses in 1997-98. It is not surprising therefore that institutions and faculty members are increasingly feeling pressure to offer Web-based courses to meet economic and student demands and the recent proliferation of WBCMT seems to be in answer to this demand. Examples of WBCMTs include WebCt, Blackboard, Convene, Embanet, Real Education, eCollege.com, Symposium, TopClass, WebMentor, E-Web, Web Course In A Box, Internet Classroom Assistant, Lotus Learning Space, Softarc's FirstClass, Serf, Virtual-U, and Eduprise to mention a few.

Eduventures.com (a leading e-Learning independent industry analyst firm), in an October 2000 industry research report established that Blackboard had the strongest market position at the time the report was published. The same report also stated that WebCt had also reached a sizable share of the market and that with its partnership with Thompson Learning it is in an excellent position to match or even surpass Blackboard in the coming months. The report mentions Campus Pipeline and Jenzabar as other WBCMT category leaders in e-Learning (Stokes, Evans, & Gallagher, 2000). Eduventures.com also predicts that the higher education e-Learning business will eventually be dominated by two or three large players, or maybe even one "killer" player. Other popular Web-based course management systems include Learning Space, Virtual-U, and TopClass (Mann, 1999). For a more comprehensive list of authoring tools and a comparative analysis of their features, visit Bruce Landon's Website at: http://www.ctt.bc.ca/landonline/index.html.

Future Implications of Authoring Tools

As discussed at the beginning of this paper, the aim of authoring tools is to automate entirely or partially the courseware construction process by supporting tasks such as the ability to create screens, screen objects such as menus and buttons, link content to other content, and sequence material (Bell, 1998). The lack of specific design principles however often restricts the kinds of instructional designs these tools support leading in many instances to the creation of simple drill and practice programs or uninteresting tutorials. "The result is a tool that supports a broad range of possible instructional applications, some of which may be good, and some of which are likely to be poorly executed, but none of which will have been created with much guidance from the tool itself" (Bell, 1998, p. 76). Murray (1998) further emphasizes this shortcoming of authoring tools when he states that "commercial authoring systems excel in giving the instructional designer tools to produce visually appealing and interactive screens, but behind the presentation screens is a shallow representation of content and pedagogy" (p. 6). So how do we preserve the level of usability and the instructional methods that instructional designers have become familiar with, and add additional tools, features, and authoring paradigms that will allow more powerful and flexible learning systems to be built?

There are two approaches that attempt to answer this question both based in an information technology perspective. The first proposes that Intelligent Tutoring Systems (ITS) need to be embodied by authoring tools to allow additional levels of abstraction, modularity, and visualization in order to achieve more powerful and flexible authoring paradigms (Bell, 1998; Murray, 1998). The second proposes that new metaphors for authoring tools need to be developed to match current theory (Hedberg & Harper, 1998), and that "of all the metaphors likely to survive, *objects* stand the greatest chance because they reflect an evolutionary improvement in the software engineering world" (Kozel, 1997, p. 42).

A New Authoring Paradigm

The object model represents an inevitable evolution in application development since interactive multimedia is both created in and delivered as software making it easier to author complex programs by thinking of interactive elements as objects. The organizing metaphor of the authoring system has become critical to the effective design of the final learning environment (Hedberg & Harper, 1998). This calls for a new authoring paradigm allowing users to spend more time designing at the conceptual and pedagogical level instead of focusing on the features of the tools to produce more engaging instructional designs (Robson, 2000). Currently for example, authoring tools for the construction of Web documents offer a page metaphor with hypertext as the dominant link structure allowing more of a "top-down" design process than the screen metaphor of more traditional low level multimedia authoring tools such as HyperStudio (Hedberg, Brown, & Arrighi, 1997). All to say that the paradigm or metaphor of an authoring tool can guide or restrict the types of instructional designs possible.

Object Oriented Designs

Both the ITS approach and the dominance of a 'true' object metaphor have one objective in common: introducing a pedagogical layer to an authoring tool in order to enable the design of more intelligent and flexible learning environments. According to Murray (1998) this is primarily achieved by representing instructional strategy and instructional content separately and by modularizing the instructional content for multiple use and reuse. This principle allows for embedding the pedagogy in the tutor for the proponents of the ITS approach, and in the properties of objects for the proponents of the object-oriented model. Such tools (in which strategy and content are separated) can facilitate the design of instructional actions by modifying the behavior of an intelligent tutor (in the ITS case), or specifying the relationship between objects (in the object model) based on the specific needs of the learner or the pedagogical characteristics of the content being taught.

Currently most authoring tools limit the designer to the pre-programmed modules of the tool and to the underlying assumptions of highly structured instructional design models (Hedberg & Harper, 1998). Furthermore, the typical ID process makes it difficult for instructors to communicate their content requiring instructional designers to see a lot of content in order to understand what the instructor wants (Robson, 2000). An object oriented approach would resolve this problem since it would be easier for instructors to translate their content into learning resources (e.g. I use lectures, assessment items, resources, etc.) and instructional designers can then create a prototypical environment matching the instructor's expectations without seeing any content at all (Robson, 2000).

Learners as Producers of Hypermedia Learning Systems

Another critical factor that could impact the pedagogical use of authoring tools is whether the learner is perceived as the *user* or *producer* of hypermedia learning environments. Hedberg et al. (1997) argue that if the activities of the learner are regarded as the central focus in an educational context then learners should be thought of as software (courseware) producers rather than software users in the development of educational software for both bounded CD-ROM titles and unbounded Web-based resources. They propose the integration of learner tools that allow users for example to organize information in a meaningful way by positioning elements on the screen, creating new links, and generating multimedia objects. Such cognitive tools could include a notebook to copy, edit and format text; a visual graphics tool to create marker buttons that point to multimedia elements such as video, audio, or pictures and enable the learner to manipulate those elements; and a cognitive mapping tool (concept mapping tool) allowing flexible information representation. The *learners as producers* concept supports a generative approach to learning, which aligns with a constructivist epistemology.

Learning Objects Systems Architecture

Learning objects systems architecture is also paving the way to support the generative use of authoring tools (Bannan-Ritland, Dabbagh, & Murphy, 2000). A learning objects system adopts an object-oriented approach for storing and metatagging instructional content and instructional strategies. Uneditable media objects called 'primedia' can be stored in a database and accessed for multiple uses in multiple contexts. Primedia can range from low to high granularity depending on their relative size as a learning resource, with highly granular resources increasing the efficiency of online instructional support systems due to their greater potential for reusability (Quinn, 2000; Wiley et al., 1999). With database-driven websites becoming increasingly popular it is certain that the future of hypermedia learning environments will be powered by such technologies instead of the static, 'hard-coded' HTML documents. Authoring systems will be designed for the creation of generically encoded reusable information allowing the design process to proceed by specifying learning resources, creating links among the resources and authoring content independently of format (Davidson, 1993; Robson, 2000). The idea is to define learning objects or resources such that each learning resource has specific instructional properties enabling its pedagogic integration with other resources. Depending on who creates, assembles and links these objects, the pedagogical philosophy of the hypermedia learning environment can vary from an instructivist to a constructivist approach resulting in a directed or open-ended learning environment as discussed earlier in this paper when comparing and contrasting CBI and WBI.

Currently Web-based authoring tools and Web-based course management tools do not facilitate the construction of learning objects however they do support some reusability of content due to the inherent archival nature of the Web as a delivery medium. They also support cognitive tools that enable users to engage in reflective and collaborative practices. In an evaluation of Web-based course authoring tools conducted by Dabbagh, Bannan-Ritland, and Silc (2001), it was revealed that the intersection between pedagogical considerations and the attributes of Web-based authoring tools yields the most educational impact. It was suggested that a comprehensive advisement mechanism included within Web-based authoring tools, and providing guidance in the areas of pedagogical approach, instructional strategy, and on-line support and resources will facilitate more effective and engaging instructional designs. Perhaps such a pedagogical advisement layer can be embodied by authoring tools using an ITS approach or a learning objects systems architecture approach in the future in order to enable the design of more intelligent and flexible learning systems.

Conclusion

This paper discussed the heuristic paradigms and organizing metaphors underlying authoring tools and their impact on the design of hypermedia learning systems. In addition, the evolution of authoring tools from a technological and pedagogical perspective was discussed by comparing and contrasting the instructional attributes of the two primary courseware products developed using authoring tools: CBI and WBI. Three classes of authoring tools were also identified and the features and associated instructional products of each class were provided. Finally, an overview of current authoring tools, their market share, perceived shortcomings, and new authoring paradigms and their implications on the design of intelligent and flexible learning systems was discussed.

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Women and Men in Online Discussion: Are There DifferencesIn Their Communication?

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Abstract

This paper describes two studies involving men and women (n = 13) who participated in online discussions in a web-based graduate course. The purpose of both studies was to examine the frequency and types of responses these students made during the course chats and threaded discussions. The first study was occurred at the end of the course in a two-week period. Students were divided into 2 small groups in which one group discussed the assigned topic via chat while the other group discussed the same topic via threaded discussion. The following week, these groups switched discussion formats to discuss a second topic. Results of the first study indicate that both chats and threaded discussion (the primary focus of the original study) were valued and had utility. However, an unanticipated result indicated a variation in the number and type of statements made with one of the small groups versus the other. It was found that the majority female group made more frequent statements than the majority male group. This finding was contrary to our review of research in regard to 2 points: 1) results and discussion that indicate that online discussion is an equalizer between men and 2) results that indicate that females were less involved. Hence, we examined other discussion of students using both online formats involving at various points within the same course and semester. Results of the second study indicate that there were some differences in the types of statements, but the amount of statements made by both genders on average was equivalent within mixed-gender, large group discussions in the sampled 4 weeks. The findings of this second study confirmed CMC studies that indicate gender equity. However, the initial study's results are still viable. Perhaps when in same gender groups, the genders use typical communication styles in discussion and when in mixed gender groups, the discussions are equivalent in number of statements for both genders. Additional research is necessary into this issue of gender and online discussion.

Background of the Studies

Web-based and web-blended (enhanced) courses require active and interactive participation with all participants (instructor and students) and with instructional materials posted or linked to a web site. Active participation is usually conducted by locating or providing information and posting this information to a designated web site, such as shared documents, external links, and online biography of student and staff information. Interactivity requires the interchange of ideas with all participants. This interchange of ideas occurs mainly through online chats or threaded discussions. (Davidson-Shivers, Muilenburg, & Tanner, (in press), 2000; Davidson-Shivers, Morrison, & Sriwongkol, 2001; Davidson-Shivers & Rasmussen, 1998, 1999).

The computer-mediated communication (CMC) literature documents the dynamics of online discussions by various forms of communication patterns, processes, and language styles (Lawley, 1993; Adkins & Brasher, 1995; Sherry, 1999; Hara, Bonk, & Angel, 1999.) Lawley's article discusses communication and computers in terms of gender as a social construct and the political effects of technology, such as the dehumanizing aspects of technology and viewing the user as shaping the process and environment, especially virtual environments. Adkins and Brasher's study of CM groups suggests that language style of powerful and powerless speech affect interpersonal perception—being that the powerful was perceived as being more task-attractive and competent. Another finding indicated those members perceived of higher status were given more opportunity to talk. Machanic (1998) discussed the need to have institutions and instructors establish procedures and safeguards to prevent harassment and nastiness occurring in online discussions and facilitate a sense of safe community.

Other studies focused on gender differences in communication patterns in online discussions (Vrooman, 2001; Proost, Elen, & Lowyck, 1997; Wojahn; 1994; McConnell, 1997; Ross, 1996; Herring, 1993; Allen, 1995). Herring also claims that the belief that CMC is inherently more democratic than face-to-face communications may be overly optimistic with respect to gender. In her ethnographic study of academic professionals, she found that women did contribute less and with shorter statements than did the males. Ross also found that females participated less than males in small group discussions and discussed their families whereas men did not contribute to messages referring to family. While Mahoney and Knupfer (1997) suggest that research on women and language reveal that women can experience linguistic discrimination within CMC and that cyberspace is not a gender-neutral space, a recent article by Vrooman argues that online environments can produce a more equitable area for communication from both genders.

In addition, Allen's case study of men and women using the electronic mail system found no difference in number of messages sent an length of time using email; however, females rated the email more highly in various categories and reported learning from co-workers than men. In addition, Allen suggested that females tend to be socialized by supportive and nurturing. Proost, Elen, and Lowyck in their survey found that it was experience rather than gender being responsible for different perceptions of CMC environments. Wojhan compared the adult communication patterns by gender using a bulletin-board communication format; she found that the length of communication patterns of men and women was very similar. McConnell, when comparing patterns of men and women in mixed gender groups, found that men tended to talk more and longest in computer conferencing, but that women may be less disadvantaged in conversations in online than in face-to-face. Hence, there was some discrepancy in terms of contributions within CMC environments.

Based on conflicting information within the literature, the results of two studies are being examined in terms of gender equity and possible influencing factors. The purpose of the paper is to describe the methods employed in the two studies, discuss the results of each study, and identify potential influencing factors that may affect (or determine) gender equity in online discussions and that call for further research.

Methodology

Participants

Participants in the study were graduate students (n = 13) in a required course for their degree programs of study from a southeastern regional university in the USA. Approximately two-thirds of the students were female. Based on the survey results, the majority of students reported that they had computer experience with some having less experience with the Internet and WWW. Participation in the discussions was a course requirement. Confidentiality of information was maintained by having surveys collected and coded by someone other than the instructor and the analysis of the discussions occurred after final grades were posted.

Course content, organization, and requirements

The course was an introductory course on trends and issues in instructional design. The course was organized by weekly topics with assignments and questions being posted to its website. Two or three questions were given with directions on how to post (either chat or threaded discussion) answers and replies. Students had a week to respond to any listserv question(s) and were also required to reply at least twice to other students' responses during the week. Typically one additional question was scheduled for an hour and a half chat during the week. Chats were large group (whole class) in which most students were able to attend. Students were also assigned particular readings as preparation for discussing the weekly topic. They were also encouraged to draw on their own experiences, knowledge and skills. Both threaded discussion and chat could be copied and all of the chats were distributed to all members of the class. After the fifth week of the term, students were assigned as discussion leaders to facilitate the weekly discussions in both chats and threaded discussions with guidance from the instructor. The instructor participated directly in the online chats; however, less so when another student was the discussion leader. With the threaded discussions, she added her comments to a summary at the end of the week rather than commenting during the week.

Data Gathering Procedures

The following procedures occurred for gathering the data:

1. Obtaining Transcripts of chats and threaded discussions.

Study 1: Transcripts of the small group discussions for chat and threaded discussion for week 13 and 14 were coded using a coding scheme developed by the Davidson-Shivers et al (1999) based on the work of Piburn and Middleton (1998) and Williams and Meredith (1996). See Table 1 for the coding scheme.

Study 2: Transcripts of the discussions for 4 different weeks (weeks 5, 7, 10 & 15) were then coded using same coding scheme. There were two threaded discussion questions and one chat for each week; all of these discussions were whole class rather than students being divided into small groups.

2. Training of researchers.

The researchers were trained to use the coding scheme and then coded each discussion transcript independently. The transcripts were coded by each completed statement/thought made rather than using a line-by-line method. The coding and analyses of the discussions did not occur until after the final course grades were posted. Complete sentences, incomplete sentences, and short phrases were considered as a statement if a new or different thought was presented within them. Incomplete sentences or short phrases were often used within the chat due to the speed and interactive nature of this format.

3. Handling discrepancies in coding.

Discrepancies encountered in the coding were resolved by review and discussion of the statement and the researchers coming to consensus.

4. Surveys were analyzed for demographic data, computer and web experience, and attitudes toward web-based instruction.

Table 1. Types of Discussion Participation Coding Scheme

SUBSTANTIVE: messages that relate to the discussion content or topic.

Code
1. **Structuring** – Statements which initiate a discussion and focus attention on the topic of the discussion. These statements are often made by the discussion leader or instructor (i.e. "Today we are going to discuss . . ." or "This week's discussion will focus on . . .").
2. **Soliciting**—Any content-related question, command or request which attempts to solicit a response or draw attention to something (i.e. "What do you think the author meant by . . .?" or "Give us some support for that assertion.").
3. **Responding**—A statement in direct response to a solicitation (i.e. answers to questions, commands, or requests). Generally these are the first response to a question by a given individual.
4. **Reacting**—A reaction to either a structuring statement, to another person's comments, but not a direct response to the question. (i.e. "Your earlier statement got me to thinking about . . ." or "I agree/disagree with Bob because . . .").

NON-SUBSTANTIVE: messages that do not relate to the discussion topic or content.

5. **Procedural**—Scheduling information, announcements, logistics, listserv membership procedures, etc.
6. **Technical**—Computer-related questions, content, suggestions of how to do something, not related to the topic directly.
7. **Chatting**—Personal statements, jokes, introductions, greetings, etc.
8. **Uncodable**—Statements that consist of too little information or unreadable to be coded meaningfully.
9. **Supportive**—Statements that although similar to chatting, there is an underlying positive reinforcement to the comment! (i.e. "Good idea!" or "Excellent work!"). *Note:* This type was added when the researchers met for consensus of their coding of the transcripts.

Source: Davidson-Shivers, Muilenburg, & Tanner, 1999. Adapted from Piburn & Middleton (1998) and Williams & Meredith (1996).

Results

Study 1

In the initial study, students were randomly assigned to either a small group chat or threaded discussion during one week of the course (week 13). In the second week (week 14), the same groups switched discussion modes on another topic question. Using qualitative methods and a coding scheme, the researchers coded the transcribed discussions to find out whether of the students' participation were substantive (directly related to the topic) or non-substantive (not directly related to the content) in nature. Results indicated that overall students' discussions included all 9 types of substantive and non-substantive comments. However, it appeared that there was a remarkable difference in terms of types and amounts of responses between these two groups.

The majority female group had greater numbers of responses and reactions (substantive categories) in both chat and threaded discussion than did the majority male group. In addition, the majority female group made more chatting and supportive comments (nonsubstantive categories) than did the males during the two-week period. When reviewing these patterns in terms of face-to-face situations, the findings are not that surprising. Tannen (1990) suggests that females in face-to-face conversations with each other, tend to use more words and elaborations as well as supportive comments than do males in similar situations. However, the results are in sharp contrast to findings in computer-mediated communication literature, which suggests that communication patterns of men and women in online discussions are similar (Wojhan, 1997; McConnell, 1997).

Study 2

In this second study, the focus was to analyze the interactions of these same students in chats and threaded discussions drawn from 4 different weeks (week 5, 7, 10 & 15). These discussions involved a mixed gender group. Results were mixed in terms of any differences in which gender had greater amounts of these two main categories over the four weeks. In terms, of the non-substantive categories, the females tended to have made slightly greater numbers of chatting and supportive comments than males. When comparing male and female discussion leaders the female showed a greater amount in those same two non-substantive categories than did the male leader. Both males and females showed the greatest amounts of messages in the responding and reacting (2 of the substantive categories) and were fairly equal in amount overall. It appears then that differences in male and female discussions are diminished when looking at substantive remarks in online discussions using a mixed gender group. The results of this second study supports the idea that CMC tends to be an equalizer among men and women when in mixed gender groups. However, the findings of the second study do not necessarily negate the results of the initial study. Perhaps when in same gender groups, men and women tend to revert to their natural patterns of conversation.

Discussion of Results

As suggested in the review of literature, perhaps there is opportunity for women to create a new model for online discussions and that females are less disadvantaged in online discussions than in face-to-face meetings after all (Wojahn; McConnell, Vrooman). And based on the initial study's findings, perhaps women can make a strong contribution in online discussion. However, there remains the question of why the findings in both studies may have occurred.

Pure speculation may indicate that when groups are same gender rather than mixed gender, communication may revert back to typical gender-based communication (Tannen, 1990). Tannen suggests that men use a parallel form of communication with each other which is when each communicate his own ideas without necessarily commenting on the other's; it tends to be a side-by-side type of pattern without much discussion or interrelationship between the males' comments.. Women tend to have a relational type of communication, in that one female states something that in turn is commented on by the other female and in a sense they take turns sharing and supporting ideas between themselves. Women often use more words and talk more than men; estimated at 25,000 per day compared to a man's 15,000 per day (source unknown).

The increase in amount of supportive statements by the female students may be indicative of a tendency for this gender to provide supportive comments to each other (Tannen, 1990) or acknowledge points made by each other (Wojahn, 1994). McConnell (1997) also suggests that men tend to support conversations at the end whereas women tend support conversations throughout the dialogue. These findings of the initial study, and to some degree the second finding, are similar to face-to-face conversations within same gender groups (Tannen, 1990; Wojahn, 1994; McConnell, 1997) as well as in terms of supportive comments being a female characteristic, whether biological or socially constructed (Herring; Lawley; Mahoney & Knupfer).

Students having had face-to-face communication prior to going online may also have evoked a feeling of community and allowed for initial impressions and perceptions of individuals to be made (Adkins & Brasher; Herring; Lawley). With such impressions, the second study may indicate that the powerful may not have been the typical perception of gender-based power, but that of one who displays confidence and higher status in the group discussions. In addition, the face-to-face may have facilitated safe feelings when going online (Machniac, 1998). Ross states that when students with high CMC skills may have been sympathetic to those less skilled students who encountered higher rates of technical problems. This phenomenon appeared to occur in the course as well, again promoting a sense of community and support.

The instructor's teaching style and manner helped established both in the oncampus class and online may have had an effect on sense of community. Procedures and safeguards may have been in place so that students felt safe as Machniac suggests. There is a tendency for males to do more flaming than females(Vrooman; Ross); yet, little to none of that occurred within the course.

Further Research Needed

This set of study yielded more questions than it answered and indicates that further exploration of communication patterns and gender in online dialogue is needed. First, the methodology of the various studies shared in this paper vary greatly, simple replication of the various studies will enhance the discussion on the issue of gender equity and online discussion. The type of group—mixed- or same- gender—may make a difference in the types and amounts of communications between and within gender. Investigations of the discussion patterns with use of whole class and small groups need to occur as well.

In addition, the effect of instructor presence, gender, and teaching style may make a difference on the gender equity in discussions with participating students. Such factors may relate to power of speech, perceptions of speaker, and language style as discussed by Herring and other scholars in the CMC literature. All of these factors may affect the interactions of students in online discussions and ultimately, the success of web-based instruction. It is an issue worthy of further examination.

Finally, examination of communication patterns of children and adolescents by gender as well as course content also needs to be considered. The topic of the course as well as age of the participants could add a richness of information to the discussion in terms of gender and online discussions.

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Defining the Limits: CyberEthics

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Abstract

How should people behave when using the computer? How did you learn "right" and "wrong" in cyberspace? We surveyed teachers and students to understand how each group views ethical online behavior. Our research indicates that while students and teachers share some insights, they do not share the same viewpoints on all cyberethics issues. This discussion will address the need for a common forum and interactive ways for sharing ideas on cyberethics issues to develop a student's ethical decision-making abilities.

Introduction

Ethical behavior online, particularly among young people, is of increasing concern to various segments of our society. Before we can influence this or any behavior, we need to understand the factors that shape it, including social influences, cognitive and emotional factors and attitudes. The purpose of this study was to study students' knowledge and opinions about online behavior and to ascertain whether their views differed from those of the adults around them. In order to provide an appropriate context for these questions, three areas need to be explored. First, what are the unique characteristics of ethics in cyberspace – what are the dilemmas, and how do we define ethics in cyberspace? Second, what do we know about moral development in general, and how does it transfer into cyberspace? Finally, what is the social context of online behavior, and how does it impact ethical behavior?

Issue I: Ethics and Cyberspace

Ethical Dilemmas in Cyberspace: Students often test the social limits of what is considered acceptable behavior, both online and in the real world. While it is the major transgressions that create headlines, routine decisions that have ethical implications are made every day by students of all ages. Often these decisions are made without careful consideration of these implications for individual students or for our society.

Three key types of issues have emerged: intellectual property, privacy/security and free speech/hate speech. Intellectual property issues include plagiarism, Internet file sharing programs like Napster, and software pirating. Privacy and security issues range from hacking to surveillance software such as the FBI's Carnivore and unauthorized cookies deposited from websites. Freedom of speech issues can be seen in the discussion of online censorship, cyberporn and cyberhate. All three types of issues host multiple opportunities for ethical decision making. Indeed these same issues are the subject of several contemporary works by lawyers, philosophers and computer scientists. (Hamelink, 2001; Lessig, 1999; Ludlow, 1996; Sykes, 1999)

Definitions of "Ethical" in Cyberspace: Regardless of the particular issue under discussion, both students and teachers question when it is appropriate to transfer our understanding of ethical behavior from the classroom to the online environment. However, students and educators do not necessarily share the same viewpoints on cyberethics issues, nor do they bring the same skill sets to the ethical decision making process. Most notably, while students often are more experienced in using online technology, teachers are more familiar with the process of ethical decision-making. Finally, there are many situations that do not have clearly defined social boundaries. When is it okay to download and use a picture? Is a web site with negative comments about fellow students an example of free speech or slander? Is bypassing the security of a system for a good cause heroic or unethical?

Issue II: Moral Development and Moral Education

Although little research on moral behavior in cyberspace has been conducted, we do have an idea of how students develop moral behavior generally. James Rest (1983) identified four major processes that contribute to moral behavior: moral sensitivity, moral judgment, moral motivation and moral character. Moral sensitivity relates to an individual's ability to recognize the moral dimensions of a situation. Moral judgement, which has been studied extensively by Kohlberg and Turiel, involves the ability to decide which course of action is more morally sound. Moral motivation recognizes the level of importance the individual places on acting morally, and moral character assesses the individual's ability to persist in a moral course of action even in the face of difficulties. According to Rest, all four processes interact to determine the observed final behavior. Research so far suggests that moral sensitivity (Bebeau, 1994) and moral judgement (Schlaefli, Rest & Thoma, 1985) can be enhanced by educational programs. Moral motivation and moral character have not been as clearly addressed. One component of moral motivation are the social norms of one's reference group.

Nancy Willard's research on cyberethics makes use of a similar model to Rest's. She has proposed examining the relationship of empathy to moral motivation, and applied Bandura's social learning theory to processes of disengagement, which may weaken moral character. (Willard, 1997; Willard, 2000). Results of her study are forthcoming and hold promise for understanding how teens make ethical decisions. (Willard, 2000).

Issue III: The Social Context of Behavior in Cyberspace

Efforts to study the social context of unethical cyber behavior are limited. Recent sociological work on the hacking community proves interesting. While headlines often portray the hacking community as a collection of "pathological" individuals, two studies address the complex social dimensions that define and negotiate the boundaries of acceptable behavior within this community (Himanen, 2001; Jordan and Taylor, 1998). The group ethos of this particular community dictates that hacking should not be used for theft or individual gain. In fact, these studies note that the hacking community has developed it's own set of standards to define "ethical" hacking. Jordan and Taylor note that this community ethos can distinguish between hackers and cybercriminals -- those who seek personal gain from their illicit actions. Himanen contends that hacking represents a change in approach to work. Hacking reflects "a general passionate relationship to work that is developing in the information age" and "…the hacker ethic is a new work ethic that challenges the attitude toward work that has held us in its thrall for so long." (Himanen, 2001:ix)

Purpose of the Study

The current study attempted to elicit information relevant to the issues described above. Specifically, the study was designed to assess students' and educators' intuitive understanding of ethics and ethical decision-making, their ability to apply that knowledge to cyber dilemmas, their understanding of how to teach and learn an ethical awareness, and their sensitivity to the social context of cyberethics issues.

Method

Focus Group Formation

Five focus groups were conducted using modified Socratic questioning (see below for a description of the procedure). Group 1 consisted of 5 post-secondary educators from Marymount University. Group 2 consisted of 5 K-12 educators from suburban Northern Virginia public schools. Groups 3-5 were drawn from counselors and campers at a summer computer camp in Washington D.C. Group 3 consisted of 15 late elementary and middle school students and Group 4 consisted of 16 high school students. The students in these groups came from a variety of neighborhoods around Washington D.C., however most were of higher socioeconomic status. Participants, who were mostly male, were attending the camp due to their interest in computer technology. Their computer expertise varied. Although this group is not representative of the population as a whole, their computer expertise and interest in cyberissues was desirable. This study was designed to define issues and gather information from those students most likely to be aware of situations which require cyberethical decision-making.. Group 5 consisted of 13 computer camp counselors. These participants were college students, most of whom had significant interest and expertise in computer technology. As with the younger groups, this groups expertise and interest level was significantly greater than the general population, but this was desirable in order to gather information from students on the "front lines". In addition, this group's experiences counseling younger children on their use of computers meant that they in some ways bridged the gap between educators and students. The focus groups were videotaped with the exception of Group 5, which was audio taped. The authors were present as observers for each group session.

Focus Group Procedures

For each group, objects related to computers and cyberethics issues were displayed on a table. These objects included items with an obvious connection to the issues discussed (e.g. a computer hard drive and an Acceptable Use Policy) as well as items that were more tangentially related e.g. plastic "bugs" and "worms". The group facilitator for all of the groups was an expert in Paideia methods of seminar discussion. The opening question invited the group to examine the items on the table and discuss their ideas with regard to these items. Follow-up questions were designed to encourage participants to elaborate on their own and each other's ideas. A final question was designed to relate the topics discussed to the participants' own experiences.

The focus group discussions were transcribed and analyzed thematically in order to determine issues of central importance to each group as well as to determine the similarities and differences in the issues raised by each group.

Results and Conclusions

Four major themes were identified across all of the focus groups studied. Each theme is identified and discussed below and illustrated with quotations from the focus group discussions.

Theme 1: The cyberethics "authority" recognized by students is much younger than the offline ethical authority.

When asked, "How do people learn ethics?" all groups recognized the importance of parents in shaping a child's basic understanding. Students explain: "I think people learn a lot of their ethics from their parents. Whether they get what their parents are teaching them or something else. But I think it's a lot from their parents or whoever raised them, and their parents give them a way to react to what others say so they can take it in think about it and what your primary values are probably shared with your parents." (High School) Teachers agreed: "Kids look to teachers, parents …to set examples by how they behave… Over a period of time you develop a hierarchy of values. You can compare a given situation and place in context. (You) learn from parents, others important in life that you value their judgement. (You) have to value it before it makes a difference to you." (Educators)

However, as children get older, the relative importance of parents declines: "It changes at different times in their lifetime. Young kids are more likely to accept parents and not question. They question more as they are influenced by others and then they question anything parents say in adolescence." (Educators)

Teens acknowledge that teachers aren't always the ultimate authority: "If you think about it…, your teachers haven't gone through these troubles (referring to cyber dilemmas) for years and your just going through them right now and maybe things have changed from when they were kids so on some points I think your friends are wiser about what you're going through than your teachers are." "Friends might put you on the wrong track, (but) teachers might too. Society has changed a lot, on some points." (High School)

When asked "How did you learn right and wrong in cyberspace?" students responded: "I taught myself right and wrong, especially because on the computer I taught myself how to fax things and how to fix programs." (Elem/Middle)

In fact when it comes to the Internet, the ethical course of action is often defined by those between 19 and 25 years of age: "… the Internet culture is controlled, not by 50 year olds or 60-year olds, it's us. Our age. We talked about when you sort of lose your ethics when you go to college… You're like, alright! Ethernet connection and you start downloading more MP3s than you would ever do, songs you hate, cause it was a fast connection. …my parents don't really understand the Internet at all so they can't really make ethical judgements based on it. So the ethics come from 19-year old high school students, the ethics that we use on the Internet. We say everybody does it, well everybody on the Internet or most people are Internet are probably under 30. The majority of that (group) is probably under (the age of) 25." (College)

To summarize, students and teachers recognize the important role parents play in shaping children's basic understanding of ethics. Both groups agreed that as students get older, the importance of parents and adults declines. Teens acknowledge that teachers aren't always familiar with contemporary dilemmas resulting from new technologies. In fact, when it comes to the Internet, ethics are often defined by young adults ages 19 to 25.

Theme 2: Students of different ages use different mental frameworks to decide ethical online behavior.

Online communities, like AOL or GeoCities, provide definition to the social boundaries that middle school students acknowledge. "When I first signed on to AOL, there's like email that says 'Welcome'... Then you check it and we printed and put it right in the center where everyone would see it so they would obey what AOL says. Like, don't hack, don't mess around with stuff. (The) long email says what you shouldn't do." (Elementary/Middle) "At GeoCities it didn't give me as long a set of rules, but the only reason you can get on there is to get a web site. So it has rules about what you make (for) your web site. When I started reading them, there are all the rules, pretty much the same: don't download things that are illegal things, don't download MP3s on your site." (Elementary/Middle)

High school students consider what is appropriate in terms of the "moral" or ethical impact their actions have on others and society at large. "I think it's appropriate to use (it) for school, but it's not right to send off a virus. You are destroying another person's property" "I had a romantic image of hackers like the movie Hackers for one, they bring down an evil corporation like the Westerns where the outlaw would kill the corrupt sheriff or something but a lot of times it's not like that at all because major corporations can lose billions of dollars and that can cause many repercussions like downsizing" (High School)

College age students often use a "legal" framework as their guide to "ethical" behavior. After extensive discussion about how to decide what's right in relation to the Internet, one college student reflected on the relationship between laws and ethics: "We keep talking about what is legal and illegal as our moral code. …A lot of people go by The Ten Commandments and some of those things are law, official United States law… But they are a kind of a code of ethics that we can go by and live by…." (College)

These students see the line of distinction between ethics and laws as a personal decision "You have to do it personally. You have to come to personal decisions…" "…the reason that we come to law is that ethics are personal, whereas laws are something that we share, that are attempting to sort of approximate the general ethics without imposing on ethical differences." (College)

Importantly, all age groups learn right and wrong in cyberspace from their hands-on experience. "People have to learn things from experience and I think that the only way of learning something no matter how much you believe them, you really need to learn for yourself." (High School) In fact, students suggest that ethics in general is learned through experience. "I don't believe that any form of ethics is learned directly... Ethics is learned indirectly from various sources." (High School)

To summarize, students of different ages use different mental frameworks to decide ethical online behavior. Middle school students use online communities, like AOL or GeoCities to define social boundaries. High school students consider what is appropriate in terms of the "moral" or ethical impact their actions have on others and society at large. College age students often use a "legal" framework as their guide to "ethical" behavior. For all age groups, right and wrong in cyberspace is learned from hands-on experience.

Theme 3: When considering "appropriate" and "inappropriate" behavior online, some issues are clear for both teachers and students, however many others are not.

Advances in technology create new challenges for ethical decision-making. While educators insist most cases are still a matter of "basic values," students at the college level suggest that cyberrules are different. Discussing intellectual property, educators explain: " You need to show (students)... they can achieve what they want in an honest way, these MP3s things are a good example, a lot of people understand why that might be wrong because they respect the artist. They don't (necessarily) see intellectual ideas as property the way music is the artists' property." For this educator, it's merely a matter of drawing parallels between intellectual property that students recognize and the new situations that emerge in cyberspace.

Younger students often express confusion over what's "legal," particularly when it comes to downloading music: "It depends, ...if you download live album tracks, that's illegal. But you can go to places like Listen.com and it's legal you can download it to a CD. Places have a license to have you copy it, that's what they are for." (Elementary/Middle) When referring to using graphics and music from an online web site, another high school student explains: " If the person tells you ok, the person with the Web page and MP3s, (says)... click here if you want it, (they are) giving (you) permission. As long as you have your friend's permission." (High School) "Like I was saying about plagiarism laws, it's really not illegal until you start trying to make money off somebody's idea. I have copied things on CD into MP3 files because of ease of access. I don't try to sell it or spread it around online so it's ok." (High School)

Educators are aware of the challenges posed by these new technologies, but maintain that our current standards offline apply in the online environment. " Technology has made it so much more complex. There's the issue of sampling in music, are you going to footnote? It's done by serious musicians, classical musicians. It's hard to know where to draw the lines. Or using Photoshop and making something new out of it. That's serious art. How do you acknowledge that? We're in difficult water here. It was pretty clear about footnotes and books, but it's harder with more arcane technology. There's proper research and I think it's important that educators and parents teach the proper way to do research. We (teachers) have to define material that is correct."

In spite of these new challenges, educators emphasize the need to use traditional techniques. "That takes us back to old fashioned sources of good documentation, good references, how to check out something that might be fraudulent. It's harder now because it's click, click, click away. We need to ground kids in book culture until we know how to find our way in the new culture."

College students clearly articulate some of the complexities involved. For example, they suggest that it is "harder to see a victim with any online crime. It all started with cassette tapes. …I mean nobody in their right mind actually thought …I'm doing this horrible thing when they …copied cassette tapes. And then you got the Internet and all of a sudden instead of just… copying cassette to cassette tape, you're copying CDs, you're copying books, you're copying art. Everything suddenly with the Internet went from a small issue to …the point where you can copy entire movies, you can copy entire books in seconds. And I think our ethics weren't ready to expand. …Anything I could copy in an hour wasn't that important." (College)

Students see the online environment as distinct from the offline world. They acknowledge that the way people interact with one another online adheres to different standards. "You act different when you're being ethical on the Internet, than when you are being ethical in real life." "I mean I'm not ON the Internet. There are parts of my life that I (am) showing through a website... ...you don't put forward your whole self. ...You're maybe an image of yourself, but not your real self. We can be more free with other people. We take advantage on the Internet." "I think basically what it is, is the Internet is just a lot less real to people than the real world. And that's why it's called cyberspace. It's not called the real world." "...people just don't think of the Internet as a real thing with real consequences." (College)

But more than just a place where inhibitions or even better judgement are left by the way side, students question the fundamental assumptions concerning what is right and wrong in cyberspace. When discussing intellectual property in the online environment, they explain: "it's like when you're a little kid you're told don't steal that book because it's his book. If you steal that book he can't use it. On the Internet, if you steal his book, he still has his copy of the book and now it's just you have a copy of the book too. ...the standard ethical rules you drive into little children just don't apply as much on the Internet as they do in the working order world that's out there in other places." (College) These same questions have been posed by philosophers at MIT (Ludlow, 1996).

To summarize, some issues are clear for both teachers and students. Other issues are not so clear when it comes to considering "appropriate" and "inappropriate" behavior online. Advances in technology create new challenges for ethical decision-making. While educators insist most cases are still a matter of "basic values," college students suggest that cyberrules are different.

Theme 4: Educators can encourage ethical behavior by recognizing the type of situations that make unethical behavior attractive and challenging students to channel their technological expertise in positive directions.

Educators are well aware that students have a great deal more technical knowledge than they do: "It will take all our brains and energy to keep up with them." But they are optimistic that most students want to do the right thing. They believe must establish clear examples of what's "right." "It's still a real minimal number compared to the whole. 98% do what's right 99% of the time. Kids who steal cars now and then. (The main) issue is being consistent and clear. This is appropriate and acceptable. It should not be a mystery. Let kids know. It really needs to be spelled out, taught, probably from kindergarten."

Students suggest that educators focus on the positive and keep the list short! "When you first sign up to AOL you get a 75 page email or so anyway, it's really long and you're supposed to read the whole thing long long thing (we were) so anyways if you read it there's 50 million rules and it's weird it's annoying also they never what they tell you what you can do, just what you can't do. It would be better if they sent the can dos and then you have a shorter list to read and you can picture the bad things." (Elementary/Middle)

Reinforcing ethical behavior requires educators to actively engage students in a dialogue. The younger generation learns by doing! "Past experience has a lot to do with it. Have to learn things the hard way, from experience. If people just tell you something you really have to see if for yourself." (High School) "You have to do it personally. You have to come to personal decisions or you can tell kids to do that themselves.... So I think that's one way that they interact." (College)

Educators recognize some situations make unethical behavior attractive and emphasize the importance of carefully evaluating expectations. “I think the pressures on them – they talk about how they have to perform at such a level in 10 different activities and be able to sleep two hours a night and be the king and queen… A lot of youngsters rationalize - 'I can get this done, I just need some help from cyberspace, a buddy, a friend, etc.' Either they don’t see that or they do see and the pressure is so high. That’s their way of meeting those demands placed on them. Especially in high school, starting in about 7th grade.”

Still, there are those students who engage in unethical behavior just for the challenge. “It’s a game to some people, you can’t get caught, can’t get killed, like a game or a test of their ability. “It’s a challenge they need and the Pentagon is the ultimate challenge. Go to a more impenetrable challenge.” “…For a lot they are kind of total losers in real life, (who) keep to themselves, (and have) no power... ...in cyberspace I have power. What a power trip hacking into the Pentagon. Kids with no friends. ‘I beat the Pentagon hack protectors.’ ” (High School)

Finally, it is important that educators provide opportunities that challenge those students with technological expertise. By channeling their expertise in a positive direction, teachers can provide students with opportunities to take ownership and act responsibly. “One of the problems at my school is vandalism. They were taking the balls out of the mice. It gets really old. The Lab was inoperable... ...We talked to SGA (Student Government Association) to get the students involved... What are the consequences of this kind of vandalism? You’re behind on your project because someone thinks it’s funny, but you are burdened. Only faculty and staff were owning this problem. We asked them to help us deal with it. It’s kind of like when I first started teaching. My father told me to find the biggest kid in the room and make him your friend. It was good advice. Find the smartest computer kid in the room, get help from them, help them resolve problems. …Sometimes they do it for the challenge - that’s a good value, looking to explore new territory. Adults have to channel that into something constructive. ...That talent should be directed somewhere where it doesn’t destroy property… …Channeling it... ...you (can) do a tech based project and have them help you teach the project. All of a sudden they have ownership and they aren’t going to screw that up to lose the power or the satisfaction. They (the students) are teaching the teacher. (It’s) called pride. You give them back to channel it. They were sitting there all day putting inappropriate pictures on the screen savers. Then you say can you put in some pictures of the Civil War, using the same skills. And citing, of course!” (Educators)

To summarize, educators can encourage ethical behavior by recognizing the type of situations that make unethical behavior attractive. In addition, it is important to provide opportunities that challenge students to channel their technological expertise in positive directions. Students who take ownership of their work are less likely to act in ways that are destructive to the online community.

Future Directions

At present, the most common response of educational institutions to the challenges of cyberethics has been to hand out an Acceptable Use Policy (AUP) and a set of plagiarism guidelines, require students and parents to sign it, and wait for the ball to drop. As this paper demonstrates, the questions these issues raise cannot be addressed by a single statement of principles, however well crafted. The answers are too varied and unclear for easy, unequivocal answers. No AUP can anticipate every possible problem that may arise. Instead of prescribing policy, students and educators need to establish an ongoing process of ethical discourse when dealing with cyberethics issues.

If we see cyberethics issues as more akin to other types of moral dilemmas, the research on moral education can provide us with some direction. Narvaez, Bebeau & Thoma (1999) noted that Rest’s four stage model can be used to classify various approaches to moral eduation in K-12 schools. According to their analysis, moral education in the public schools historically tends to reflect society’s particular moral concerns which have ranged from the “macromorality” concerns of the 1960s (the Civil Rights movement, anti-war protests) to current pre-occupation with attempting to curb perceived youthful antisocial aggressiveness by emphasizing self control and “10 Commandment” type prescriptions for moral behavior. Using the four component framework, this reflects a shift in emphasis from moral judgment to moral character. The effectiveness of current “character education” approaches has not yet been established (Leming, 1997 in Rest, et. al., 1999). It would seem logical that approaches that address multiple components of moral behavior should be more effective than those that address only one component. Thus, any approach to cyberethics education should address issues of moral judgment, moral character, moral motivation and moral sensitivity.

Insights from brain-based learning research (Caine and Caine, 1991) also can guide cyberethics education. This research indicates that students must connect what they are trying to learn with what they already know to retain the knowledge. Traditional presentations of instructional material organize that material into the educator’s categories of knowledge. With a subject like cyberethics, this traditional approach is particularly unlikely to yield effective results since the student’s categories of knowledge may differ quite significantly from those of the teacher.

Educators and students need to engage in dialogue that can help both groups question their decisions concerning the use of ethical standards. In this process it is important to recognize that everyone will not come up with the same answer or agree on a single “ethical” course of action. All can agree that decisions should be based on sound reasoning and ethical principles.

Where ethical standards can be applied, we need to document the harm of ignoring an ethical course of action. This can help students develop moral sensitivity and enhance moral motivation as they see the consequences of their behavior on what are usually perceived as “invisible” victims.

All of us --students and teachers together-- must actively question the changing boundaries that result from technology transfer. These questions cross many disciplines in the humanities and social sciences:

- How do students of different ages, developmental stages, and cultures grapple with “ethical” in the online environment?
- How are social boundaries changing and thus defining what is appropriate and inappropriate online?

- What social forces shape these definitions?
- How do economic and political pressures influence our judgments and behavior?

Using the interactive nature of the Internet itself may prove to be a very effective means of facilitating this kind of ethical discourse about online behaviors. The linear features of online technology allow students to select multiple paths through new material rather than one set, prescribed course of study. Digital “scaffolding” techniques can assist students as they apply abstract concepts to contemporary issues. Scaffolding refers to the guidance students are given while completing a complex task like ethical decision-making. Students are given only the amount of help that is needed, as that help is needed. The teacher gradually withdraws assistance, allowing the student to complete the task independently. Scaffolding is designed to support students through more complex tasks with the amount of support they need, and no more (Jonassen, Peck and Wilson, 1999). Using these techniques to engage students in brain-friendly ways, and addressing all aspects of the four-stage model described above should yield a rich, comprehensive approach to exploring cyberethics issues and developing students’ moral sensitivity, judgment and decision-making capabilities.

The stakes involved in becoming a more ethical society online are not trivial. With our increasing dependence on computer technology for tasks as significant as maintaining medical records, controlling air traffic, ensuring national security, and conducting businesses large and small, the unethical actions of a few have the potential to impact society on a massive scale. Helping our students acquire the awareness, the motivation and the means to become ethical decision makers in cyberspace is critical in order to prevent such impacts from occurring.

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A Posthoc Review of Two Potential Communities of Practice

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Abstract

There is a growing interest among organizations in identifying and nurturing Communities of Practice. However, defining a Community of Practice, distinguishing it from a team, and nurturing the growth of a forming Community of Practice can prove to be challenging. By considering two case studies in a posthoc fashion, two potential communities of practice will be defined and characterized. Finally, a discussion of how best to nurture a newly formed community will take place.

Introduction

Delineating what is and what is not a Community of Practice (CoP) is not a clear-cut task. Although many definitions of Communities of Practice exist, assessing the degree to which a group meets the components that make up the criteria of these definitions is often subjective and difficult at best. One specific area of difficulty is distinguishing between a team and a CoP. Because there are strong similarities between the two, it is often helpful to outline the areas where teams and CoPs differ. A final area of difficulty with regard to a CoP is determining, if one does indeed exist, how best to nurture its existence in an effort to provide fertile soil for its development. This paper will look at these three areas: (1) defining a CoP, (2) distinguishing between a CoP and a team, and (3) identifying ways to nurture a CoP. The framework for addressing these questions will be from the perspective of a posthoc review of two case studies: the ISUnion Web-design Team and the actual virtual community developed by the Web-design Team. The purpose of the Web-design Team is to develop an electronic, web-based infrastructure to support the development of a virtual community of dialogue. The purpose of the virtual community is to nurture dialogue among existing practitioners, faculty and current students in the area of performance technology and instructional systems design.

The ISUnion is an interactive web site designed and created by graduate students of the Instructional Systems (IS) Program at an academic institution in the Southeastern United States. The ISUnion consists of components such as an interactive forum, news, a knowledge management/survey center and an employment center. The original goal of this web site is to build a virtual community of students, alumni and faculty to develop, improve and promote the IS Program at the institution. This website came into existence in September 2000.

Communities of Practice

Diverse definitions of Communities of Practice exist, yet they have many similar characteristics. The phrase "community of practice" was first used in 1991 by Etienne Wenger and Jean Lave. In 1998 Wenger published the work, "Communities of Practice: Learning, Meaning, and Identity" which describes communities of practice as a "community created over time by the sustained pursuit of a shared enterprise." Wenger further clarified Communities of Practice as "groups of people who share information, insight, experience, and tools about an area of common interest". (Wenger, 1998)

The Value of a Community of Practice

Why are communities of practice worth identifying and nurturing? They bring the power of a self-organizing, social entity to play in an otherwise often highly structure world. "Self-organizing" means that it is based on a degree of intrinsic motivation and perceived value. People are a part if the community because they want to be. When they no longer find value in the community, they either change the community or leave it. The fact that a CoP is a social entity brings the dynamics of the complexity and interrelations of two or more persons interacting. This relation is seen to be exponential in its power as opposed to linear.

Many organizations including business, government, and not-for-profits, have seen the potential of communities of practice. Organizations such as Hewlett-Packard, the Department of Defense and the World Bank have all developed technical means of supporting communities of practice. Often this takes the form of discussion boards or electronic data sharing.

Because of the change in our global economy from that of being an industrial society to that of an information sharing society, organizations see the value of capturing the knowledge that exists within communities of practice. Within knowledge management frameworks, organizations not only attempt to capture existing data and information, but they also see the value of capturing knowledge, expertise and wisdom. Today's workforce no longer places their loyalties with a single company. Whereas a few years back it was not uncommon for a worker to retire after thirty, forty or even fifty years with a single company, today, individuals value career moves. They develop specializations. Workers move to where the career opportunities allow them to increase their expertise. From the knowledge management perspective, organizations develop electronic forums for communities of practice to share their knowledge, expertise, and wisdom. Because of the electronic infrastructure, this is now archived information, a living artifact, which an organization can now index and search. When the individuals leave the organization, at least parts of their tacit knowledge has been captured by the organization.

But simply setting up a discussion board alone may not provide a nurturing environment for a community of practice to emerge. Communities of practice take time to form. They follow an ever-changing pattern of ebb and flow. Indicators that a community of practice has formed would include the nature of the structure, the commonalties and the artifacts or products of the community (Wenger, 1998).

A CoP is formed spontaneously as people seek help, try to solve problems, develop new ideas and approaches (McDermott, 1999). People's interest, time and energy direct their participation in CoP. A CoP develops in various stages with different levels of interaction among its members and different kinds of activities. A CoP is different from a business or functional unit in that it defines itself in the members' understanding of their practice. A CoP is different from a team in that it is defined by knowledge rather than by task. A CoP is different from a network in that it is not just about social relationships.

Communities of Practice are groups of people who share similar goals and interests. In pursuit of these goals and interests, they employ common practices, work with the same tools and express themselves in a common language. What keeps people together is a common sense of purpose and a real need to know what each other knows.

Members of a Community of Practice learn from each other in solving common problems and evolving a more skilled and creative practice. They are committed to jointly developing better practice. Communities of Practice are pivots for the exchange and interpretation of information. They leverage the preservation of tacit knowledge and keep up with the development of the cutting-edge technology.

Case One: The Web-design Group of the ISUnion Project as a Potential Community of Practice

The Web-design Group consists of twenty-five members who participate in varying degrees in the design of a webspace structure to support the potential, virtual community of dialogue. In reviewing the development of the infrastructure in a posthoc fashion, it is beneficial to outline the differences between a team and a community of practice. Several articles have been written to look at these similarities and differences and to determine how the strengths of each can best be utilized within an organization (McDermott, 1999 & Sharp, 1999). Figure 1 below presents key distinguishing differences between teams and communities of practice.

Characteristics	Team	Community of Practice
Existence	Appointed	Choose (self-organizing)
Orientation	Forward view	Sense of history
Define by	Abilities	Knowledge
Driven by	Goal	Value
Progress	Via workplan	Via discovery
Membership	Fairly stable	Transient

Figure 1. Alternative Views of Teaching and Learning, 2000

The structure of the Web-design group is based on outlined project plan and individual's abilities to move the project forward. While the group was self-appointed (volunteer), there was a strong marketing effort by core members, which included benefits of participation such as training on HTML coding and graphics applications.

The commonalties of the Web-design group included a shared vision for the desired outcome. However, the group was driven by the goal of completing the project. There was no desire for long-term sustainability of the design group. Rather, a workplan, which had a specific end point, was the driving force. While many shared stories, language and jargon were noticed, it is believed that this is in part due to the common environment of the participants. All were students within the same programs, attending classes with the same professors, and moving through the same track.

Finally, the products of the group related directly to the project. Whereas with a community of practice where the products tend to be a defining element, the Web-design group looked at the products as completion points. They did not define the group in any way.

Based on the activities, social dynamics and structure of the group, and nature of the group's products, the ISUnion Web-Design group could be considered a team rather than a Community of Practice. The social dynamic as it currently exists, is strong and with the strong core value of "perceived value in the idea of the ISUnion" shared by the group, the team will most likely develop into a CoP in time. However, as it currently stands, it would be better defined as a team with strong social interactions, a shared belief in the value of the project and a firm knowledge and trust of the abilities and skills of the other group members.

Case Two: A Virtual Community as a Community of Practice – The ISUnion

Is the ISUnion (Virtual Community) a CoP? While it may be too early to answer this question, the ISUnion is a potential CoP because its structure and the target interaction conform to the characteristics of a CoP.

Organizational / Social Structure:

Members of the ISUnion are students, alumni and faculty of the IS Program at a Southeastern United States academic institution. They are informally attached to one another through exposure to the common field of instructional design or improving human performance, and they are in common pursuit of solutions to improve human performance. They hold a warehouse of knowledge and skills in Instructional Systems and Human Performance Technology. Additionally, they come from the same institution, which provides a common theoretical underpinning for the study of the particular discipline.

But the ISUnion is different from a formal organization. People who participate are all doing it out of their common interest in solving human performance or learning problems, and they all speak in the ISD jargons like " instructional objectives and learning hierarchy". Their motivation to participate is intrinsic as no reward or incentive system exists to encourage participation. People build friendships and learn from each other at virtual and face-to-face social occasions in the format of chatting, sharing experience and story telling.

Roles of Participants in the ISUnion from the Perspective of a Community of Practice

Wenger describes several roles of an individual within a community of practice. The are:

- Inbound
- Insider
- Outbound (Wenger, 1998)

"CoPs arise out of people's natural desire to share ideas, get help, learn about new ideas verify their thinking, and hear the latest "professional" gossip" (McDermott, 1998). They develop as people have regular contact with people who share their interests.

Newcomers of a CoP usually take an "observational" lookout post, both absorbing and being absorbed in the culture of the community of practice. They assemble a general idea of what constitutes the practice of the community. Their tasks are usually short and simple with small costs of errors and little responsibility. Newcomers usually perform at the end branches of work processes and start from the ground for self-evaluation (Lave & Wenger, 1991).

How does this description relate to the role of a newcomer in the ISUnion? People reach out to the ISUnion from different angles. People may have heard about the ISUnion from their department listserv, available flyers, or by word of mouth. They begin with observing, which is to check out news first, to see what is going on out there and what the web site has to offer to its target audience. Then, they will lurk on the discussion board, and jump in whenever they feel interested or have time to join the discussion if they feel that the discussion facilitated by the ISUnion is of value to them for their professional development.

"Inside" community members frequently help each other solve problems, offer each other advice, and develop new approaches or tools for their business or study. Helping each other makes it more convenient for community members to improve their weaknesses and learn together in the "public space" of the community (McDermott, 1998). "As they share ideas and experiences, people develop a shared way of doing things, a set of common practices and sources of individual identify" (Lave & Wenger, 1991).

As a member at full participation, insiders usually have a deeper sense of the value of participation to the community. Learning of an insider lies in becoming a part of the community. Insiders commit a greater amount of time and an intensified effort. They assume more and broader responsibilities and take more risky and difficult tasks. They enjoy an increasing sense of identity as a master practitioner (Situated Learning, 1991).

People enter the ISUnion to check out news regularly, to share experience bravely and to search for answers to their unsolved problems. People participate in the ISUnion can perform similar jobs or collaborate on a shared task or work together on a product. Maybe some of them work together at the same company or in the same classes, maybe some are working on a mutual assignment. They are peers in the execution of the real work. What holds them together is a common sense of purpose, which is to improve their ISD practice, and a real need to communicate what each other knows in order to broaden their insights and vision in the ISD field. They ask each other for advice on completing their ISD projects, they share successful or painful experience in past projects and discuss about the direction of development in the ISD field.

Students talk about their accomplishments and concerns, and express their expectations and ambition for our program. Alumni share stories of their practice in the field or make known their admiration and loyalty for their alma mater reflecting on the foundation they built while there, and helping to strengthen our current program by sharing their information, experience and talent in the IS field. Faculty members maintain a close connection with students and alumni for a common purpose, to express their thoughts on a program they greatly influence (ISUnion Proposal, 2000). At the same time, more experienced and well-respected alumni or faculty members can act as thought leaders or coordinators of the CoP to initiate activities and guide the direction of people's interactions.

A community of practice is a living entity, in a "constant state of motion"; evolution. As such, people move towards the edges of the community, following an outbound path towards the ever-changing boundary "defining" the community of practice from the outside "world". There are several reasons why a member of a CoP would be on an outbound path. These include:

- Conflicts or shifts in time and energy
  Since CoP is not an official required organization for people to join, people's participation in a CoP depend on their individual commitment of time and energy. Even though participating in CoP is valuable to people, it is easily ignored because of other more pressing tasks (McDermott, 1999). Also, if a person's energy level does not allow him to attend any CoP activity after work, this person will very likely to choose to rest for next day's work instead of going for a CoP meeting.
- Conflicts or shifts in values
  Another important issue that caused people to leave a CoP is the conflict or change in the value of an individual and the shared value of a CoP. Sometimes, a community member joins a CoP when his or her temporary needs or value match the CoP value. After a while, his or her needs or value may shift according to the change in his or her situation such as a job shift. This person's value may not match the one of the CoP any more after he or she changed his or her job, and he or she will choose to leave the previous CoP, or maybe join another CoP.
- CoP not engaging or effective enough to hold people together
  Because of the emergent and spontaneous nature of a CoP, sometimes it is not well organized or managed efficiently. If the CoP activities are not focused on knowledge and skills essential to both the practice and the people; if there is no

respectable community members or thought leaders involvement or coordination; if personal or community interactions are not active or enthusiastic, community members will lose interest in the CoP activities and the CoP is going to diminish. Specific to the ISUnion, potential reasons why people would be on an outbound path are:

- Not enough involvement
  It is possible that people will leave the ISUnion if it does not have enough opportunities for individual or community interaction. Most people would not like to participate if they see very few people interact with each other, and there are no major professional figures (experts) within the participants. They would consider that this CoP is not very popular among the practitioners in the ISD field, and guess that there might be less value in committing time and energy to this CoP.
- Not active or current
  It is likely that people will stop observing or lurking on the ISUnion if they find out that there is not much change in the topics or feedback of the discussion forum, or the number of hits to the web pages have very slow and slight increase. They would think that the topics discussed on this web site is not related to the most current core value so that nobody would like to contribute.
- Not entert aining
  Due to the self-emergent and self-organizing nature of a CoP, the stability of the community can easily deteriorate if the contents or activities provided by the ISUnion are not attractive enough to hold its visitors for a comparatively long period of time. It will be very difficult for a member of the ISUnion to have to discipline him- or herself to keep coming back to visit the web site if there is not any fun or interesting elements related to the field, which appear on the web sit e regularly and frequently.
- Time and energy
  Some people may have to stop attending the ISUnion temporarily or permanently if their job, study, or personal load does not give them any space for any other commitment. For example, there is a fluctuation in the number of hits to the ISUnion between ordinary school days and the week for the final exam because most of the participants are working in the educational area.

What are the potential benefits of a CoP?

Communities of Practice provide an opportunity for people to solve real problems in ways that formal processes can not anticipate. There is always a formal ideal way of performing a task or completing a study assignment such as Service Standards or the requirement on a course syllabus. But after we do things in the real settings for a period of time, we may have pulled out from the Service Standards or syllabus a gist of the ideal way or have formed our own thoughts or experience of performing the task. This set of informal or improvised knowledge is what we can share with each other within a Community of Practice to become an efficient and skillful performer of our tasks, but what we can not always obtain from formal education or instruction.

Learning is more about becoming a member of a community than it is about absorbing information. It is considered a social process built around informed participation. This applies to the learning of tacit knowledge, which refers to “intuition, judgment, and common sense—the capacity to do something without necessarily being able to explain it”. Tacit knowledge exists in the special practices and relationships that emerge from working together over time. People draw out the tacit knowledge that others possess by having human interactions to construct a common context to understand each other and the trust to be willing to share ideas. (Brown & Gray, 1995)

Why do people want to join ISUnion and Can we benefit from ISUnion ?

- The ISUnion is a badge of identity.
  People who participate in the ISUnion identify themselves as a current or previous member of the IS program and the field. These people will be interested to find out about what happened in the program, what progress the program has made and what the most up-to-date research or development is in the program and the IS field. The perceived quality of the program is a reflection on all past, present and future participants in the IS Program.
- The ISUnion is a place to meet people.
  People involved in the ISUnion activities are the ones who really would like to meet (may be virtually) with other people working or studying in the same field, and to form a social relationship with them. Now more than ever, people realize the importance of networking with people working in the same field. They try to improve their learning and collaboration by building trust between each other first. For this purpose, they will actively take part in most of the activities proposed by the ISUnion for them to meet people face to face or virtually. An additional benefit of the ISUnion is the forming of a web of participation and networking. The ISUnion web site presents the most current news of events happened in the IS program. It is updated every month with the most recent stories of events and photographs. People come to the ISUnion to read about what has just happened and what is going to happen so that they can share the common topics when they encounter other members of the community. People get together face-to-face when there is any conference or social event announced by the ISUnion, and these events become the major “real” (as opposed to virtual) human interactions of the CoP.
- ISUnion is a way to learn.
  Another major reason, hopefully the most important one, for people to be engaged in ISUnion is to learn from each other and to produce better practice. The discussion topics posted on the interactive forum can be a big attraction to the target audience. People can raise their questions or problems by posting them into the forum. If other people find the topics interesting and relevant to their particular problems or experiences, they would try to offer solutions or share their similar encounter by carrying out an asynchronous on-line discussion. Other members who visit the web site may also regard this

exchange of information valuable to their job or study. Thus, learning will be disseminated within the whole group of target audience.

The ISUnion offers an alternative way to learn about the real work experience from alumni and faculty members, about how academia relates to “reality” and how the combination of theory and practice is dynamic in nature. Summaries of interviews of alumni and faculty posted on the web site inform us about stories of achievements and failure. These real-world stories may be different from the ideal settings and methods learned from the courses offered by the IS program. These stories provide us with a context to connect classroom study with the real-world requirements, and create a more realistic view of the ISD field. Conversely, a theory “worked out” on the web site via dialogue may have a change effect on a current practice in the field.

Via the ISUnion, we have the opportunity to learn what is impossible for the academic IS program to offer--- the tacit knowledge by becoming a member of the community. The tacit knowledge that is embodied by the community of the ISUnion refers to the intuition, judgment and common sense serving the purpose of improving human learning and performance. This tacit knowledge can only be acquired by involvement with the students and practitioners in the ISD field. The ISUnion offers us one more opportunity to interact with these people and to have one more exposure to and possibly working with this embedded knowledge.

Nurturing the Community

Having demonstrated that the community for which the ISUnion is serving is in fact a community of practice, and that there is a potential benefit to the community for using ISUnion, we must now determine how to increase its use. At present we have identified four areas of potential improvement. The four areas that are currently lacking are involvement, interaction, time/energy, and entertainment.

Involvement, for our purposes, is defined as communication between community members. Some possible ways to increase involvement are storybuilding, case debates, and increased discussion. Storybuilding would consist of individuals ‘writing’ a collective story. A second proposed technique is sponsorship of case debates. The concept is to post elements of an instructional or performance analysis and allow community members to discuss and debate subsequent actions. A final proposal to increase involvement is to increase activity on the discussion board. A couple of ideas in this area are to have recognized leaders and experts in the field moderate discussions and to restructure the mechanics of the discussions so that they are not linearly structured.

Interaction, for our purposes, is defined as utilization of the site. Examples of ideas to increase community use of the site are a case study database, electronic library, day-in-the-life-of documentaries, and daily updated material. A case study database could be a repository of cases studied within the classroom, experienced in the Performance Systems Analysis course, and encountered by alumni. Such case studies would include as many elements as possible from the initial contact hopefully through a complete evaluation. Such a repository would be of immense benefit for many different members of this community, from students learning the processes for the first time to veterans of the field doing research. A second idea to increase the member interaction would be to digitize current videos from the Learning Resource Library. Such videos represent seminars with leaders of the field as well as recorded courses. Other material could also be added to the library, such things as lecture notes, PowerPoint presentations, and old tests. Another element for increasing interaction could be documentaries of leaders in the field and alumni of the program. A final idea is to have daily “___’s”. This could be a daily quote, daily word, daily wisdom, and etceteras.

Time and energy seem to be in short supply for many members of this community. As such, this site should help reduce time and energy expenditures of the community members. Some ways to accomplish this could include posting projects from the Computer Courseware and Electronic Performance Support Systems classes that might be of benefit to the community. Such courses could include accessibility requirements, copyright laws, and software introductions. Instructors can use the site within courses. An example of such use might be to interview alumni online. Interviews are currently a requirement in one course, by conducting them online there is a record which others can benefit from. Furthermore, course credit could be given for work done on the actual site. The program that supports the site is not very strong technically and some students feel this is a deficit with the program. By providing credit for technical work on the site, the site, the student, and the program gain some benefit. A final method to reduce time and energy consumption is to use the site discussion board. At present the online courseware supports discussion but does not provide a notification option. The ISUnion discussion board does provide this option.

Finally, the site could be made a bit more entertaining. This could be accomplished through the use of such elements as jokes, comic strips, and interactive games. There could also be a ___-cam. This would be something along the lines of a fish-cam, but with an object of interest to the community.

All of these potential methods of nurturing the community are technical and require deployment time. Many of them also require a repository in place prior to deployment. Several also require individuals to commit to moderating discussions or provide material. However, much of the material does exist or would not require much effort to prepare for the web. The question that must be answered is whether the extra effort provides a large enough benefit to the community to be worthwhile.

Conclusions

A Community of Practice takes time to develop. Communities of Practice are organic and self-organizing. They need time to find what kind of information to share, who the participants are and the “best” methods to communicate (McDermott, 1998). For example, McDermott mentions the experience of Shell’s Corporation with the nurturing of successful communities of practice. They started with a group of six to eight people meeting weekly to discuss some technical issues. It took them six months for word to spread of the value of these discussions. Then the number of people that attended the weekly meetings increased to about forty.

ISUnion is created as an intentional community of practice, which is "intentional in its focus". But to develop the trust, connection and sharing of natural communication, it is necessary to support the natural process of community development instead of imposing an artificial one (McDermott, 1998).

Are these two entities of the ISUnion destined to be communities of practice? Only time will tell.

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Increasing Preservice Teachers' Capacity for Technology Integration Through Use of Electronic Models

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Abstract

Current teacher educators are being challenged to find opportunities for their preservice teachers to develop both competence in, and confidence for, integrating technology into their curricula. Given the difficulty involved in trying to arrange successful classroom technology experiences for preservice teachers, this study was designed to examine whether electronic models of exemplary technology-using teachers, presented via CD-ROM, could provide a viable alternative for developing ideas about and self-efficacy for technology integration. Sixty-nine students enrolled in a one-credit technology course completed demographic and online survey instruments before and after interacting with a CD-ROM that featured six teachers' classroom technology beliefs and practices. Results suggest that electronic models can significantly increase preservice teachers' ideas about and self-efficacy for technology integration. Furthermore, students' found the examples of teachers included on the CD-ROM to be both realistic and relevant. Implications are discussed as well as suggestions for future research.

Introduction

According to the most recent report of the National Center for Education Statistics (NCES, 2000), nearly 70 percent of teachers report not feeling well prepared to use computers and the Internet in their teaching. The 1998 Technology in Education Report (Market Data Retrieval) noted that only 7 percent of schools, nationwide, boast a majority of teachers at an advanced skill level (i.e., able to integrate technology into the curriculum).

Even among our newest teachers, instructional use is not as high as might be expected. Contrary to popular belief, preservice and beginning teachers do not use computers significantly more than their more experienced colleagues (Hadley & Sheingold, 1993; NCES, 2000; Sherwood, 1993). Although beginning teachers report *wanting* to use computers, and have gained adequate technical skills, they typically lack knowledge about how to integrate computers within the more routine tasks of teaching and managing their classrooms (Hruskocy, 1999; Novak & Knowles, 1991).

Skills vs. Ideas

Clearly, the growing increase in teachers' technical skills is insufficient to guarantee the effective use of technology in the classroom (Carvin, 1999; Marcinkiewicz, 1994). In order to translate skills into practice, teachers need specific ideas about how to use these skills to achieve meaningful learning outcomes under normal classroom conditions. Traditionally, inservice technology training programs have been software- rather than curriculum-based (Gilmore, 1995). Thus, teachers completed technology courses still not knowing how to create or implement small- or whole-group activities that incorporated meaningful uses of technology (Moersch, 1995). Unfortunately, this also has been true for most teacher education technology courses (Moursund & Bielefeldt, 1999; Yildirim, 2000). Although the majority of teacher preparation programs now require that students take three or more credit hours of technology instruction, recent survey data suggested that most teacher education faculty still do not feel that technology use is being effectively modeled for our future teachers (Schrum, 1999).

Simply stated, few of our current or future teachers have either observed or experienced learning with or from computers (Carlson & Gooden, 1999). While today's teachers are expected to leverage the full potential of powerful conceptual technology tools to meet the changing needs of their students, they have been given few, if any, opportunities to develop their own visions for, or ideas about, meaningful technology use.

The importance of developing a vision for technology use cannot be overstated (Ertmer, 1999). As noted by the Office of Educational Research and Improvement (1993): "Most teachers will find little incentive to tackle the technical and scheduling problems associated with technology unless they have a clear vision of how the technology can improve teaching and learning" (p. 83). Once a clear vision is in place, specific tools and strategies are needed to help teachers address the many unique challenges posed by the translation/integration process: changing roles of teachers, students, and technology; classroom organization, management, and security issues; and assessment methods, among others. As Dexter, Anderson, and Becker (1999) explained, "For teachers to implement any new instructional strategy, they must acquire new knowledge about it and then weave this together with the demands of the curriculum, classroom management, and existing instructional skills" (p. 223). Teachers need information about how, as well as why, to use technology in meaningful ways. Lack of knowledge regarding either element can significantly decrease the potential impact that these powerful resources might have on student learning.

Self-efficacy Beliefs

Yet even the best ideas about technology use will remain unused unless teachers believe that they are capable of implementing them in the classroom. In particular, teachers' beliefs about their *ability to use computers* in instruction may be key, given the role self-efficacy is proposed to play in determining behavior. According to Eachus and Cassidy (1999), "self-efficacy has repeatedly been reported as a major factor in understanding the frequency and success with which individuals use computers" (p. 2).

Self-efficacy refers to personal beliefs about one's capability to learn or perform actions at designated levels (Bandura, 1997). According to Bandura, self-efficacy is based, not solely on the level of skill possessed by an individual, but on judgments about what can be done with current skills. That is, self-efficacy comprises beliefs about what one is *capable* of doing, not about whether one *knows* what to do. As such, self-efficacy is thought to mediate the relationship between skill and action. Therefore, without knowledge or skill, performance isn't possible; yet without self-efficacy, performance may not be attempted. According to Bandura, "beliefs of personal efficacy constitute the key factor of human agency" (p. 3). Thus, teachers who have high levels of efficacy for teaching with technology are more likely to participate more eagerly, expend more effort, and persist longer on technology-related tasks than teachers who have low levels of efficacy.

If self-efficacy beliefs are key to performance and increased self-efficacy can lead to increased performance (Christoph, Schoenfeld Jr., & Tansky, 1999; Schunk, 1981), how can we help teachers increase their efficacy for technology use? Researchers in the area of self-efficacy (Bandura, 1997; Schunk, 2000) describe four primary sources of information that can influence judgments of efficacy: personal mastery (successful task completion), vicarious experiences (observing models), social persuasion ("I know you can do this!"), and physiological indicators (emotional arousal, relaxation).

Next to personal mastery, vicarious experience is thought to provide the most valid information for assessing efficacy (Schunk, 2000). According to Olivier and Shapiro (1993), "vicarious experiences with the computer increase one's feelings of control and confidence. These encounters also make an individual want to learn more about the technology, thus reducing and eventually eliminating the fear of the unknown factor. As the fear and anxiety diminish and positive experiences add up, self-efficacy and the willingness to cope with mastering the task will increase" (p. 83). Given the logistical difficulties involved in providing preservice teachers with enactive experiences related to successful technology integration, teacher educators have turned to modeling as a feasible, yet powerful method for increasing teachers' ideas about and self-efficacy for technology integration (Schrum, 1999). Not only can models provide information about *how* to enact meaningful technology use but they can increase observers' confidence for generating the same behaviors. Furthermore, providing access to multiple models increases both the amount of information available about how to accomplish the performance and the probability that observers will perceive themselves as similar to at least one of the models (Schunk, 2000), thus increasing their confidence for also performing successfully.

Electronic Models

Still, the use of models does not guarantee either learning or later performance. Many factors have been shown to influence observers' responses to models including the prestige and competence of the models, consequences experienced by the models, perceived similarity of the models to the learners, as well as learners' own self-efficacy for performing the behaviors (Schunk, 2000). In addition, research has yet to establish whether models, presented electronically, can be used to achieve results similar to those achieved with live models. Will learners perceive themselves as similar to models that are presented electronically? Will they regard the models as both realistic and relevant? Given the increasing potential to present models of exemplary technology use via multimedia technologies, it is important to determine the extent to which pre- and inservice teachers can benefit from observing these types of electronic models.

Purpose

This study was designed to examine the effects of electronic models on preservice teachers' perceived ideas about, and self-efficacy for, technology integration. Specifically, exemplary technology-using teachers were presented via a CD-ROM teacher development tool, called VisionQuest. VisionQuest features the classroom practices of six k-12 teachers and is designed to support users' reflections on both the underlying beliefs and classroom strategies that enable exemplary technology use. Given the few opportunities preservice teachers have to observe exemplary technology use in actual classrooms during student teaching or observation sessions (Carlson & Gooden, 1999; Vannatta & Reinhart, 1999), VisionQuest was developed to provide these opportunities. Specifically, the research questions guiding data collection and analysis included:

- What effect does observing exemplary technology-using teachers, presented electronically, have on preservice teachers' perceptions of ideas about technology integration?
- What effect does observing electronic exemplary technology-using teachers, presented electronically, have on preservice teachers' perceptions of self-efficacy for technology integration?
- What are students' perceptions of the use of electronic models for learning about technology integration?

Methods

A pretest-posttest research design was used to examine increases in preservice teachers' ideas about, and self-efficacy for, technology integration following two 50-minute class sessions in which students used VisionQuest, a CD-ROM teacher development tool designed to present exemplary models of classroom technology use. Participants' perceptions of their learning experiences were collected via classroom observations and interviews with 10 purposefully selected students. Both quantitative (paired t-tests) and qualitative (pattern seeking) analysis methods were used to examine the extent to which electronic models offered a viable method for increasing preservice teachers' capacity for technology integration.

Role of Researchers

The research team consisted of a faculty member and five students enrolled in an advanced educational technology research course at a large Midwestern university. Students had varied background experiences, in both k-12 and post-secondary classrooms, and were seeking masters (*n* = 1) or doctoral degrees (*n* = 4) in educational technology. The team worked collaboratively to design the study and develop appropriate data collection instruments. Each researcher collected survey, interview, and observation data from students in one of the six course sections participating in the study. Survey data were combined and analyzed by the team; interview and observation data were used primarily to triangulate quantitative results.

Description of Site and Participants

Of the 103 students enrolled in six sections of an undergraduate educational technology course, 69 students signed a consent form and completed all three data collection measures needed for the study. *Classroom Applications of Educational Technology* is a one-credit optional course offered as a "companion" to the required 2-credit introductory course. Participants ranged in age from 18-34 years, with a mean of 20 years. The majority of the students were female (65%), sophomores or juniors (71%), and majoring in Elementary Education (60%). Eighty-seven percent of the participants had computers at home and, at the time of the study (week 10 in the semester), indicated that they used computers primarily for word processing (98%), electronic mail (99%), and browsing the Internet (98%). When asked to rate current levels of computer skills, from novice to advanced, 75% of the students rated their skills at an intermediate level while 9% rated themselves as beginners; 16% rated themselves as advanced. None of the students rated themselves as novice users.

Description of VisionQuest

As an instructional tool, VisionQuest (VQ) is designed to provide opportunities for users to explore models of effective technology integration. Users examine the steps that three sets of teachers have taken to achieve their current levels of technology use. Cases include a high school team of three biology teachers, a middle school music teacher, and an elementary team of two second-grade teachers at a science and technology magnet school. Users examine how teachers' pedagogical visions of classroom practice have shaped their integration journeys including how they got started, the roadblocks and challenges they faced, as well as the incentives that moved them forward (highlighted by the Roadmap components of Figure 1). The cases illustrate that technology integration can be successfully achieved in a variety of contexts despite differences in settings, resources, and student backgrounds. Users examine, both within- and across-cases, the relationships among teachers' beliefs (related to classroom organization; the role of the teacher, students, and technology; curricular emphases; and assessment practices) and current classroom practices related to technology (illustrated by the Path and Destination components of Figure 1).

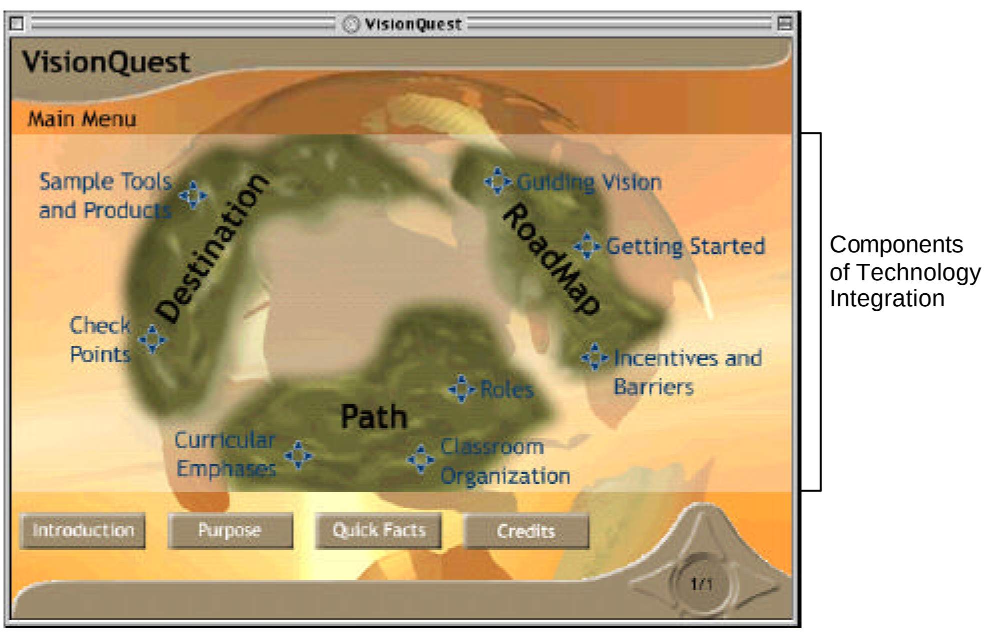

Figure 1. Screen shot from main menu depicting 7 components of technology integration.

VisionQuest initiates user reflection through the use of video segments, augmented by electronic artifacts (lesson plans, student products) from teachers' classrooms. Cases are constructed such that users can explore teachers' classrooms either one at a time (case by case) or thematically (i.e., comparing components of technology integration across cases). Each case contains a variety of elements that combine to illustrate how teachers' visions for technology use are translated into practice (see Figure 2). Users examine how teachers planned for integration, how they currently implement technology within their classrooms, and how they assess the impact of their efforts.

Figure 2. Screen shot from a content page of VisionQuest.

At the time of the study, VisionQuest was in beta format. Although navigational features were still somewhat rudimentary, "workarounds" were built in so that students could effectively use the software to complete the tasks assigned.

Procedures

Demographic information was collected from the participants during the first class session of the semester. During weeks 10 and 11, as part of their normal class activities, all students worked with VisionQuest, completing two different tasks. During the tenth week, students evaluated VisionQuest as an example of professional development software. During this week, questions were specifically directed toward software quality and not software content. Although the majority of these data are not relevant to this study, two questions provided information about students' perceptions of the VQ models and will be discussed later. Students focused on content the following week when they used VisionQuest as a modeling tool to examine the beliefs and classroom practices of the teachers included on the CD-ROM. Students were asked to describe how the different teachers prepared their classrooms for technology use, how they used various grouping strategies to manage their rooms, how they managed classroom "chaos," and so on. At the end of this session, students were asked to list the components of classroom organization that the three groups of teachers had considered prior to implementing technology in their classrooms.

Data Collection

At the beginning of the tenth class session, prior to evaluating VQ, students completed an online survey designed to collect three types of information. First, information was collected regarding students' computer ownership, current use, and perceptions of skills and comfort using computers (e.g., "I enjoy working with computers." "When using computers, I can deal with most difficulties I encounter."). Eight items comprised this initial section. The second section included seven items regarding students' *ideas* for technology use (see Figure 3). Items were presented in a Likert-style format; students were asked to rate their level of agreement (from 1-strongly disagree to 5-strongly agree) with statements related to the possession of specific ideas regarding technology use. The third section used the same seven items as the second section but with an emphasis on the possession of *confidence* rather than ideas (e.g., "I am confident I can use one computer effectively during large group instruction." "I am confident I can use technology effectively to teach content."). Students used the same rating scale (from 1-strongly disagree to 5-strongly agree) to record their levels of confidence. Students' responses to the online surveys, prior to using VQ, comprised pretest measures of students' perceived ideas about, and self-efficacy for, technology integration.

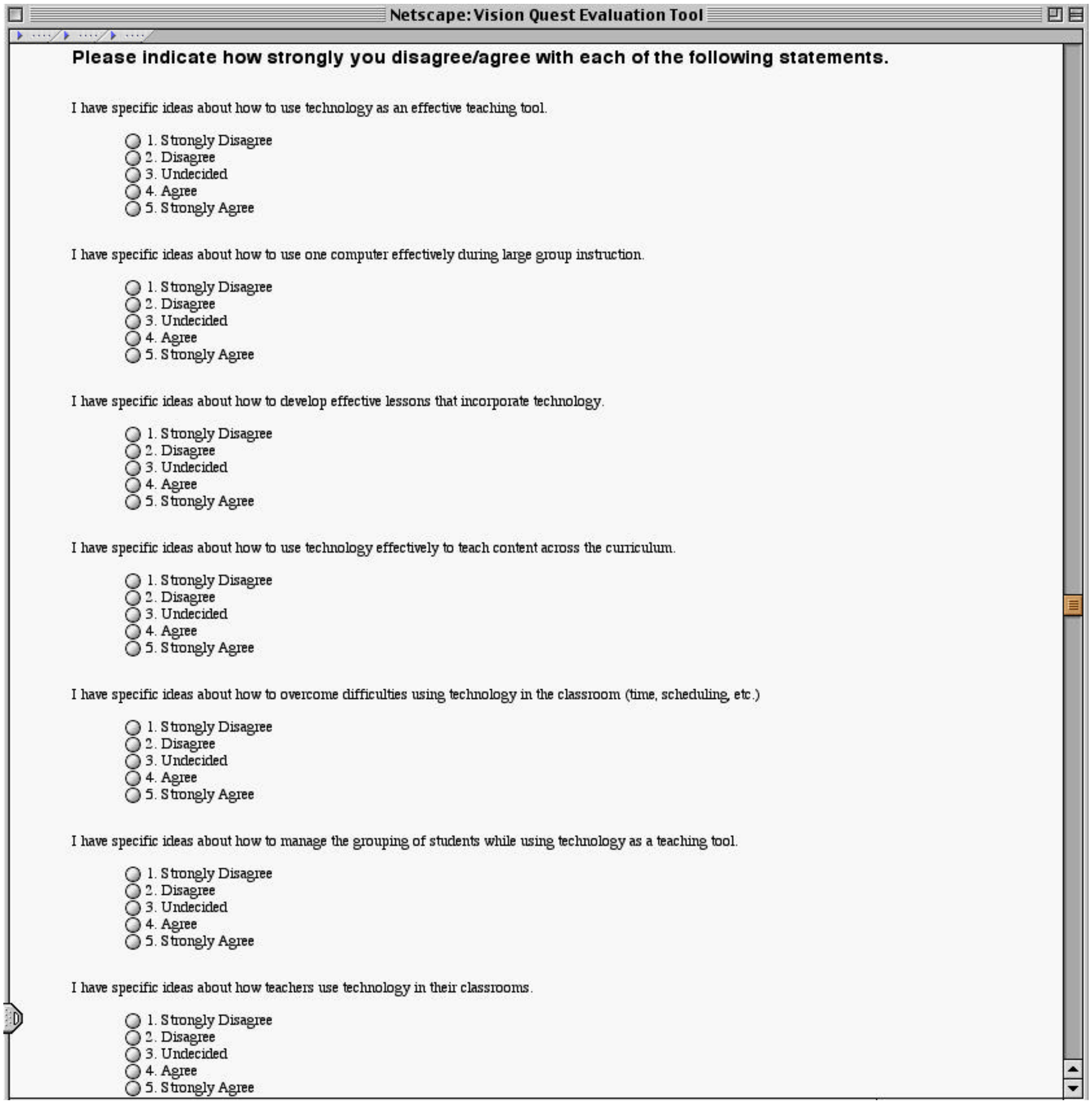

Figure 3. Screen shot from online survey: Ideas about Technology Integration Survey

At the end of the eleventh class session, after students had explored the ideas presented by the models on VQ regarding classroom management strategies, they completed the second and third parts of the online survey again. These measurements served as posttest indices of students' perceived ideas about, and self-efficacy for technology integration. In addition, four items were included to explore students' perceptions of using VQ as a modeling tool (e.g., "I can relate to the examples of teachers shown in VQ." "I can relate to the examples of technology shown in VQ.").

During both class sessions in which students interacted with VQ, one or two researchers were in attendance, making observations of students' engagement with the software. Observations provided evidence of the "holding" quality of the software and also provided useful information for the selection of interviewees. Students were purposefully selected for interviews (one or two per section) based on noted levels of interest, with an attempt to choose one highly- and one less-engaged student from each section. Interviews were scheduled at a time convenient to each participant and were audiotaped and transcribed by the interviewer. Interviews focused on identifying specific ideas (about classroom organization, assessment practices, etc.) that students gained from VisionQuest and the extent to which they thought they would use these ideas in their classrooms. We were particularly interested in knowing whether students regarded the VQ models as "real" and whether they believed that they had learned from them, just as they might learn from live models.

Data Analysis

Demographic data were tallied and percentages calculated to identify general characteristics of participants. Changes in students' perceptions of their ideas about, and self-efficacy for, technology integration were determined using paired t-tests. Pearson correlations were calculated to determine relationships among ideas and confidence (pre and post) and specific demographic characteristics.

Interview transcripts were analyzed using a simple pattern-seeking method to determine students' impressions of the software and the impact it may have had on their ideas and confidence. Analysis efforts focused on comments that either supported or negated quantitative findings in order to validate, extend, or modify initial results. In addition we examined students' perceptions of using electronic models to determine whether this type of modeling tool might present a reasonable alternative to observing live models.

Issues of Validity and Reliability

Reliability was increased through the use of consistent data collection methods. Students in all six sections of the course completed the same online surveys--data were electronically transferred to an Excel spreadsheet, thereby eliminating possible error in entering or organizing the data. Each researcher followed the same procedures while introducing the study, conducting observations, and interviewing participants. In addition, weekly online and in-class discussions among the researchers increased the consistency of research methods used.

Chronbach's alpha was used to measure the internal consistency of the survey instruments. Calculated Chronbach's alphas were .80 on the Ideas survey and .89 on the Self-Efficacy survey, suggesting that the instruments were moderately reliable. Despite the fact that the same measures were used for both pre- and post-assessments, the possibility of experiencing a testing effect is minimal. According to Bandura (2001), previous tests for reactive effects have demonstrated that self-efficacy does not increase as a mere function of assessing one's efficacy: "If merely recording a level of efficacy made it so, personal change would be trivially easy" (p. 6).

Survey measures were evaluated by an expert in the area of self-efficacy and modified based on his suggestions, providing the instruments with a certain amount of face validity. To further increase validity, multiple data sources were used to triangulate findings. For example, observations provided a rough measure of students' levels of engagement, interview comments verified their excitement about the software, and survey measures indicated that students found the VQ examples relevant. Together, these data provide strong evidence of students' engagement in, and identification with, the models provided on VQ and as such, helped us answer our third research question.

Results

Changing Ideas and Efficacy for Technology Integration

A two-tailed paired t-test (df = 68) indicated a significant increase in students’ ratings of perceived ideas about technology integration (t = 8.85; $p < .0000$) from pre- to post survey. Students' judgments of their ideas for technology integration increased from a pretest mean of 3.72 (SD = .44) to a posttest mean of 4.12 (SD = .40).

A two-tailed paired t-test (df = 68) also indicated a significant increase in students’ ratings of perceived self-efficacy for technology integration (t = 3.46; $p < .000$) from pre to post survey. Students' judgments of confidence increased from a pretest mean of 3.84 (SD = .52) to a posttest mean of 4.05 (SD = .47).

Since it is fairly easy to achieve high correlation coefficients with larger samples, significance levels were set relatively high in order to discount high coefficients that were not meaningful. That is, we did not consider coefficients to be significant unless the probability of occurrence was less than p = .0005. Thus, based on a critical r value (df = 66) of .35, correlations among demographic characteristics and pre- and post- ideas and self-efficacy indicated no significant relationships among age, gender, or year in school (freshman, sophomore, etc.) and ratings of computer skills, ideas, or self-efficacy (see Table 1). Although one might expect advanced college students (e.g., juniors and seniors) to have more skills, ideas, or confidence, this was not the case in this study. Furthermore, there were no significant relationships between gender and any variables examined in this study.

Table 1. Correlation Coefficients among Selected Demographic Variables and Pre/Post Measures of Ideas and Self-Efficacy

	Age	Class	Gender	Computer Skills	Pre Ideas	Post Ideas	Pre SE	Post SE
Age								
Class	.73							
Gender	.18	.14						
Computer Skills	-.15	-.13	-.02					
Pre Ideas	-.09	-.09	-.12	.34				
Post Ideas	-.19	-.14	-.09	.28	.61*			
Pre SE	.05	.02	-.10	.18	.72*	.52*		
Post SE	-.14	-.09	-.12	.26	.48*	.84*	.50*	1.00

* p < .0005
Note: SE = self-efficacy

Significant correlations were found between students' perceptions of their ideas for technology integration, before and after using VisionQuest ($r = .61$); similarly students' perceptions of self-efficacy for technology integration ($r = .50$) were significantly correlated before and after using VisionQuest. Additionally, perceptions of ideas and perceptions of confidence were significantly correlated. Students who began with greater perceptions of ideas, also tended to have higher levels of confidence ($r = .72$). This relationship was even stronger at the time of the posttest ($r = .84$). The coefficient of determination (r-squared = .71) suggests that 71% of the variance in students' confidence ratings could be "explained" by students' perceptions of their ideas for technology integration. In other words, the more ideas students have about technology integration, the stronger their belief that they can be successful integrating technology into the classroom. As ideas increase, so, too, does confidence for implementing the ideas.

Interestingly, judgments of computer competency (skills) were not highly correlated with either ideas or confidence for technology integration. This supports earlier research findings (Moursund & Bielefeldt, 1999; Yildirim, 2000) that suggest that simple skill training is insufficient to prepare students to use technology in the classroom. Although judgments of computer skills were moderately correlated with students' ideas for using technology prior to VQ ($r = .34$; $p < .001$), this relationship was not significant after using VQ ($r = .28$; $p > .001$). Furthermore, skill competency did not seem to translate into confidence for achieving integration either pre or post VQ ($r = .18$ and $.26$ respectively). Just because students know how to use word-processing, email, and the Internet, does not mean that they know how to use these skills within classroom instruction or that they are confident trying to do so.

Perceptions of Using Electronic Models

Interviews with 10 students, as well as data obtained through four post-survey items and two software evaluation questions, were used to answer our research question regarding students' perceptions of using electronic models to learn about technology integration. Interviewees were representative of the students enrolled in the class; interviewees included both male and female students who ranged in age from 18-34 years, in skill levels from beginner to advanced, and in confidence levels from “somewhat” to “very” confident.

Two questions on the software evaluation form asked students to rate the relevance of the activities and models observed on VQ. On a scale from 1 (strongly disagree) to 5 (strongly agree), students agreed to strongly agreed that "activities regarding the use of technology were realistic" (mean = 4.46) and that "the video cases of teacher interviews and class activities were relevant" (mean = 4.31). Four similar questions included on the post survey averaged a 3.96 rating indicating that students' perceived the VQ models to be both realistic and relevant.

Although students had suggestions for improving the software (particularly in terms of navigation, which was unfinished at the time), interview comments were overwhelmingly positive. Students viewed the models as realistic, indicating that they felt as though they were in the classrooms with the teachers. Students described the "life-like" quality of the videos and how they felt that the teachers were talking directly to them (S: I felt like they were talking to me as a teacher and not as a student). As an example, one student stated:

> I liked it. I liked how I got involved when it showed you (the clips) and you felt like you were right there in the classroom with the students watching them. It’s like you’re in a movie theater almost because they have such good (videos)... and it shows the students and it shows the teachers – and you feel like you’re right there in it.

Because our survey instruments did not provide information about the specific ideas that students may have gained using VQ, we asked students to describe these ideas in our interviews. Students indicated that, by observing the classroom examples on VisionQuest, they had gained ideas about "using stations," "assessment," "group work," "using different activities to teach the same content," "integrating computer research into a music classroom," "using technology to work with different levels of students-special ed and those who excel," "using HyperStudio in a music class," and "establishing a good climate in the class." Students made many comments about how VQ allowed them to see how things were done in a classroom. Three representative comments follow:

> I think actually seeing the teachers in the video clips and how the students are actually using it and how the teachers are using it and incorporating it in their lessons-I think was really good for me. I had ideas going into VisionQuest of how I could use technology in my classroom but actually seeing teachers using it gave me some new ideas of 'Oh, I didn’t think of using it like that.

> Seeing the teachers use technology helped me to understand how it's done...it's one thing to hear someone talk about different methods, but seeing the classes actually use the technology--that really made me think of how I could do it next year.

> I liked the examples and the students' points of view. They had a lot of good ideas about what they were doing. It’s a good way to teach us about what you can do with computers. And we used a computer. This was a good way for us to see what goes on in a classroom. I could see doing things like they did.

Students agreed that it was beneficial to *hear* the teachers in addition to seeing them. Exploring teachers' beliefs helped students understand why teachers made the decisions that they did, and provided cognitive modeling of the integration task. For example, one student noted:

> I think it's really neat how you have the different clips in there, the different classrooms and you have the students' opinions and the teachers' opinions. It's got their different beliefs and teachers can take that and maybe it will change their philosophy and they can interpret new things into their classroom. I think it's a very good program and it's got a lot of potential.

> I liked it. I thought it was pretty cool the way you could see what they were doing in all those schools. The interviews were really good because you get a chance to see what they think about their own classrooms and they talk about what they want to do. You could click on the materials or the interviews.

Based on these results it appears as though students both enjoyed and benefited from observing the electronic models provided on VisionQuest. Interview comments suggest that preservice teachers perceived that the use of electronic models was a positive approach that provided "life-like" learning experiences. There were no comments to suggest that the students found it difficult to identify with the models presented via CD-ROM technology.

Discussion

This study examined preservice teachers' perceived ideas about and self-efficacy for technology integration before and after observing electronic models of exemplary technology-using teachers. Sixty-nine students, enrolled in a one-credit technology course, completed online demographic and survey instruments and then used a CD-ROM electronic modeling tool during the tenth and eleventh weeks of the semester. To measure changes in students' perceived ideas and self-efficacy, the online surveys were completed again at the end of the second session.

The results of this study support our hypotheses that electronic models can be used to increase preservice teachers' ideas about and self-efficacy for technology integration. Even though students used VisionQuest for a relatively short period of time over the course of two class sessions (approximately 90 minutes total) and were unable to explore the entire content of the CD-ROM, students showed significant increases in both their perceived ideas about and self-efficacy for technology integration. Interview and software evaluation comments indicated that students found the models to be both realistic and relevant. Students described a number of specific ideas that they gained from the models and furthermore, described their intent to apply these ideas within their future classrooms.

The 69 students who participated in this study were not novice computer users; in fact, the majority of our participants ($n = 63$) rated themselves as either intermediate or advanced computer users. In addition, initial ratings of perceived ideas about and self-efficacy for technology integration were not exceptionally low ($x = 3.72$ and 3.84, respectively). Still, ratings of perceived ideas and self-efficacy increased significantly from pre- to post- VisionQuest suggesting that students were able to gain additional ideas and confidence by observing the models on the CD-ROM.

Students' pre- and post- ratings of their ideas and confidence were not significantly correlated with their judgments of skill levels, suggesting that computer skill competency does not translate directly into ideas or confidence for classroom technology use. In fact, students' perceptions of the direct usefulness of their skills may have decreased after seeing how the teachers on VisionQuest were not dependent on high skill levels, although this conjecture requires further examination. However, there were significant correlations between students' perceived ideas and confidence, especially at the time of the posttest ($r = .84$) suggesting that as students see new ways to use technology and develop new ideas about technology integration, they develop higher levels of confidence about their ability to use technology in a variety of ways.

Based on the correlations obtained, providing preservice teachers with specific integration ideas (e.g., how to organize a classroom that uses technology, how to assess student technology products) via electronic observations of technology-using teachers may be more effective than skills training for increasing their self-efficacy for technology integration. Furthermore, by increasing future teachers' self-efficacy, we increase the probability that these behaviors will be implemented in their future classrooms. According to Olivier and Shapiro (1993), "Self-efficacy has been shown to be an excellent predictor of behavior. Individuals with a low sense of self-efficacy will, more often than not, shy away from the best alternative, and, instead, choose an alternative that they believe they can handle" (p. 84). Even when practicum and student teachers possess "positive dispositions towards computer use," they often lack confidence in their ability to teach successfully with computers (Albion, 1999). This lack of confidence for teaching with computers has been shown to influence the levels of computer use by student and beginning teachers (Albion, 1996; Handler, 1993).

The lack of significant correlations among age, class, gender, and skills and pre- and post-measurements of ideas and self-efficacy (see Table 1) suggests that all of the students in this study were able to gain ideas and confidence through their interactions with the electronic models. That is, no one group of student was more or less likely to have more ideas or confidence for technology integration. Previous research has suggested that using a variety of models increases the possibility that students will find at least one model they can identify with (Schunk, 2000) and also provides additional information about a number of effective strategies that can be used to achieve integration.

Educational Implications

The results of this study suggest that preservice teachers can benefit from observing teacher models presented via multimedia case examples, such as those featured on VisionQuest. Whether delivered via the Web or CD-ROM, multimedia models are becoming more readily available for use by teacher educators. These types of examples can be incorporated into an educational environment for self-paced exploration, as a small group reflection tool, or as an instructor-led activity. From an instructor's perspective, electronic models can positively impact the authentic nature of a course and simultaneously increase the confidence and integration beliefs of students. This type of modeling can help preservice teachers develop a vision for what technology integration looks like in real classroom as well as strategies for implementing those visions.

Limitations and Suggestions for Future Study

The primary limitation of this study relates to our inability to isolate specific cause and effect variables. Because VQ was part of the course curriculum for the students who participated, and was scheduled to be used at a specific time in the semester, we were unable to create a control group for this study. However, future efforts will include use of a cross-over design, that is, one that would introduce VQ to a control group at a later time in the semester. This would allow for a more systematic look at the effect of VQ on students' perceived ideas and efficacy.

Participants in this study were fairly homogeneous; generalization to groups differing in age, gender, ethnicity, or levels of computer competency may not be appropriate. As an example, it is unclear whether the use of exemplary models will be equally effective with novice users who are likely to begin their explorations of the CD-ROM with much lower levels of ideas and self-efficacy. There is some evidence to suggest (Snoeyink, 2000) that teachers need at least a very basic skill and confidence level before they can benefit from observing exemplary others. Because our study did not include participants who rated themselves as novice users, we were unable to answer this question.

An additional limitation of this study relates to our inability to determine if students' perceptions of having many ideas for technology integration actually translate into classroom application, as hoped. Although student worksheets and interview comments suggest that students gained new ideas, additional work is needed to determine the extent to which these students are able to carry out these ideas when they actually assume leadership of their own classrooms. Still, according to social learning theory (Bandura, 1997), building self-efficacy is an important first step toward developing the capacity to perform a particular skill. Without a sufficient level of self-efficacy for performing computer tasks, technology integration may not even be attempted (Olivier & Shapiro, 1993). Models can serve informational and motivational functions for observers (Schunk, 2000), yet further research is needed to verify the long-range benefits of increasing self-efficacy through the use of electronic models.

Conclusion

Teachers today face a number of challenges as they begin integrating technology into their classrooms, not the least of which include a lack of specific ideas about how to organize and manage integrated classrooms, uncertainty about how to implement new roles within current classroom routines, as well as a lack of confidence for implementing these new types of ideas and roles. Even as our teachers are gaining more computer skills, they continue to report feeling unprepared to use technology in the classroom (NCES, 2000). As educators begin to realize that skill training is not enough to prepare teachers to integrate technology within the curriculum, their attention must turn to helping both pre- and inservice teachers gain specific ideas and confidence for technology integration. How then, can this be accomplished in the most effective and efficient way?

Although self-efficacy theory suggests that personal successful experience with technology in the classroom is the most powerful means for building teachers' self-efficacy (Bandura, 1997), this is almost impossible to achieve in practice. Simply trying to arrange field observations of exemplary technology-using teachers is fraught with difficulty. Even if we were able to find sufficient numbers of exemplary technology-using teachers who were willing to allow visitors in their classrooms, handling the logistics related to scheduling classes, transporting students, and arranging appropriate times to visit would be a nightmare. The use of multimedia materials that incorporate examples of effective classroom use of technology helps eliminate these logistical concerns. Data from this study suggest that providing preservice teachers with opportunities to interact with exemplary technology users, through electronic models, is a viable means for increasing capacity (ideas and self-efficacy) for technology integration.

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Women's Contributions to the Leading Journals in Instructional Technology, 1995-2000

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Introduction

This study examines the articles from current journal literature in the field of instructional/educational technology to ascertain the number of articles written by women each year and the content that women are addressing in their articles. A previous study of the journal literature (Foley, Gurney, & Branch, 1994) examined women's contributions to the literature from 1988-1992. Both the current and previous analyses used methods similar to Ely's work in analyzing the literature of the field (Ely, 1996). This study uses an analysis of the topics of articles to develop themes found in the literature and compares these to the trends and issues identified by Ely (1996) and Molenda, Russell, & Smaldino (1998). Finally this study takes a critical look at these articles from a feminist perspective in regard to gender issues.

Rationale

Instructional Technology Research Agenda

A rationale for investigation of women's contributions to the literature in educational/instructional technology comes from several sources. Molenda (1996) describes an agenda for research in the field in order to "determine where the knowledge gaps are…" (p. 38) and calls for an examination of the "adequacy of journals and periodicals" (p. 40) as a means of describing communication within the profession. In addition, Molenda (1996) calls for an examination of external forces that influence the field. Specifically he asks, "What societal forces are affecting the profession? What are the forces that assist or impede the appropriate adoption of technology in education?" (p. 41).

Our personal experiences in higher education and in the field have yielded real concerns about the field of educational technology and specifically instructional design in terms of how/if they incorporate women's perspectives. Most articles, books, and literature in the field that instructional design students are exposed to continue to be written by men from a clearly masculinist perspective. That the field has the potential to change can be evidenced by the introduction of these texts by women (Driscoll, 1994; Driscoll, 1998; Seels & Richey, 1994; & Glasgow, 1990; Smith & Ragan, 1999) used in the foundational courses in the instructional design program at a leading university (personal correspondence, 2001).

A Focus on Women's Contributions

There are valid reasons why a study of the field should include a focus specifically on women's contributions. As is documented in recent statistics, teaching is (still) a female dominated profession. Findings from the 1993-94 survey by the National Center for Education Statistics show that 73% of teachers in public K-12 education and 75% of teachers in private K-12 education are women (National Center for Education Statistics, 2001). Ely also states, "There is an insistence that teachers must become technologically literate" (1996). As noted in both Ely's (1996) and Molenda's (1998) trends, computers are pervasive in education settings and educational technology is seen as a "major vehicle for educational reform" (Ely, 1996). Women, then are potentially prime purveyors of the educational/instructional technology literature as it relates to K-12 education.

Reflections on Previous Studies

The foundational study of women's contributions to the literature (Foley et al., 1994) came out of graduate experience that involved instructional design classes populated predominantly by women students without reference to one female author. At that time it was found that the percentage of articles by women in 11 instructional technology journals ranged from 68% to 20%, with "no discernable patterns [found] within each journal over the five-year period [1988-1992]" (p. 59). An analysis of the content of articles written by women revealed that most articles concerned computers (11%) and computer assisted instruction (5%) and the non-specific category of design and development (8%). Only 2% of all the articles written by women in the same period addressed gender issues. The fact that so few women in the field were not writing about gender raised the question concerning "the experiences of women attempting to publish in the field of instructional technology" (p. 59).

Ely has completed a series of analyses of the publications of the field. Most recently he identified eight trends (1996). Molenda et al. (1998) identified ten key issues from their analysis of the literature of the field. A comparison of Ely's and Molenda's findings, shown in Table 1 below, identifies many similarities and some differences.

Table 1 Comparison of Ely's Trends and Molenda's Issues in Instructional Technology

Ely (1996)		Molenda et al. (1998)
Computers are pervasive in schools and higher education institutions. Virtually every student in a formal education setting has access to a computer.	⟺	Incorporation of computer-based media into the instructional mainstream.
Networking is one of the fastest growing applications of technology in education.	⟺	Incorporation of telecommunications-based media into the instructional mainstream.
Access to television resources in the school is almost universal.	⟺	Incorporation of traditional audiovisual media into the instructional mainstream.
Advocacy for the use of educational technology has increased among policy groups.	⟺	Acceptance and support of the concept of Educational Technology.
Educational technology is increasingly available in homes and community settings.	⟺	The home as locus of technology-based learning.
New delivery systems for educational technology applications have grown in geometric proportions.	⟺	Application of advanced interactive technologies (multi-media, hypermedia, virtual reality.
Educational technology is perceived as a major vehicle in the movement toward education reform.	⟺	Restructuring/Reengineering of basic organizational processes.
Unique Trends and Issues Ely (1996)		Molenda et al. (1998)
There is a new insistence that teachers must become technologically literate.		Updating paradigms and procedures for instructional systems design. Growing interest in learner-centered, inquiry-based instruction. Commitment to increasingly authentic assessment.

Methodology

Research Questions

Two questions guided this study:

1. What percentage of articles are written by women each year in leading educational technology journals?
2. What topics are women writing about in leading educational technology journals?

Journal Selection

Selection of seven journals for inclusion in this analysis were based on Ely's (1999) identification of those publications read by educational technologists. The seven journals included in this analysis are; *British Journal of Educational Technology, Educational Technology, Educational Technology Research and Development, Innovations in Education and Training International, Journal of Research on Computing in Education, Learning and Leading with Technology (*formerly published as *Computing Teacher),* and *TechTrends*. Six of these seven journals are cited as leading educational technology journals for publishing in the field (Price & Maushak, 2000); *Innovations in Education and Training* is not included in the latter list. Analysis was conducted in these journals over a six-year period, 1995-2000.

Quantitative Analysis

The process for descriptive quantitative analysis involved: 1). documenting the number of articles written in each journal; 2). ascertaining which articles were written by women as either first or second author; and 3). determining the percentage of articles that were written by women annually for each journal. Editorials and regularly published columns were not included in this analysis. Selection of inclusion for an article was based on first or second authorship by a woman. While many articles were written by larger groups of people and women's names appeared as authors in the group, ERIC protocol limits two authors in their citations and experience has shown that lead authorship is most often ascertained by order. Because this is a study of the contributions of women in the field we wanted the articles included in this study to reflect a clear leadership role of the women authors, both in terms of content and context of the article.

Determination of gender was based on analysis of the first names of one of the first two authors. Some journals (conveniently) provided pictures of the primary authors or brief biographies that often included a feminine or masculine pronoun. Difficulties arose when authors were identified by first initials only and for those European names that are typically used by either women or men (Robin, Leslie, Lyn, etc). In addition, because neither of the coders were familiar with Asian, Arabic, Indian, and some European names, a list of unfamiliar names was distributed to colleagues from these geographic areas for further identification. For those cases, where gender could not be determined for first or second author, the article was eliminated from analysis in this study.

Content Analysis

This study employed a content analysis methodology based on Ely's (1996) and Foley's et al. (1994) previous studies. The process of content analysis involved: 1). identifying the total number of articles each year, excluding regularly published columns and editorials; 2). ascertaining the number of articles written by women as either first or second author; 3). describing the content of the article by two coders; and 4). negotiating final category placement through a dialogic process. Both coders, authors of this article, are experienced instructional designers. Coders examined each article authored by women and identified a category that best described the focus of the article. Whenever possible coders used the author's words to assign a content category. In cases where different words described the same thing, (i.e. computer assisted instruction/ computer based instruction) one category was created for both (computer assisted instruction). After independent coding, coders negotiated differences in selection of category, making a case for one or the other or collaboratively choosing an alternate category that satisfied both coders.

One difficulty in determining category arose when addressing process/product over context. Articles describing the use of technology or computers in special education were placed in the category of Education K-12. Finally, because the purpose of this study was to determine if women are writing about women's issues in the field, gender was a primary category regardless of context. Because negotiation was an essential part of the process, analysis had to be conducted in a timely fashion. Articles had to be independently coded and discussed within a short working period so that coders could remain familiar with the content of each article during negotiations.

Findings

What percentage of articles are written by women each year in leading educational technology journals?

A total of 1809 articles were published from 1995-2000 in the seven journals included in this study. Of these, 993 articles were written by women as first or second author. The percentages found in Table 2 below reflect annual averages for each of the journals included in the study. The percentages of articles written by women range from a low of 33% to a high of 74%. An analysis of the percentages shows no discernable trends, increases/decreases from year to year. Three journals (*Educational Technology Research and Development, Journal of Research on Computing in Education, and Learning and Leading with Technology*) consistently had an annual average of 50% or more articles written by women; one journal (*Educational Technology*) had an average of less than50% of articles written by women over the 6-year period. It should be noted that two of these journals are published internationally, although no differences were reflected in their annual percentages from those published in the US. All of the journals except one had a research focus*; Learning and Leading with Technology*, the exception, is a K-12 education practitioner oriented journal. Given the predominance of female teachers in public and private schools (NCES, 2001), no doubt affects the predominance of women authors in this journal. This journal was unique in another feature – it published over 600 articles in the 6-year period of this study, nearly one-third of the total number of articles. Of these 295 were in the category of curriculum development. It was felt that this inordinate number of articles in one category from one journal would skew the findings and so this number was not used in the analysis of content, but was included in the quantitative calculations of percentages of articles written by women. Clearly there is a difference between research and practitioner based journals both in terms of quantity of articles published and in the gender of the primary authors as shown in the figures below.

Table 2 Percentage of Articles Written by Women, 1995-2000

Journal Title	1995	1996	1997	1998	1999	2000	Means
Learning and Leading with Technology	54%	50%	69%	74%	74%	66%	64%
Journal of Research on Computing in Education	62%	50%	73%	63%	64%	50%	60%
TechTrends	42%	55%	55%	41%	71%	59%	54%
Educational Technology Research and Development	52%	53%	56%	50%	55%	50%	53%
Innovations in Education and Training International	54%	45%	45%	49%	63%	63%	53%
British Journal of Educational Technology	50%	47%	39%	58%	48%	69%	52%
Educational Technology	39%	37%	46%	33%	34%	40%	38%

What topics are women writing about in leading educational technology journals?

An examination of the content analysis was done on two levels. Categories were sequenced by the number of articles found in each category. From the perspective of individual categories there were nine content categories most frequently cited in Table 3 below.

Table 3 Most Frequent Topics of Articles Written by Women

Content Category	Frequency
Distance Education	49
World Wide Web – Internet	40
Instructional Strategies	35
Multimedia	35
Integration of Technology in Education	32
Effects of Technology (in any context)	30
Teacher Education	29
Computer Software	27
Professional Development	26

Further analysis clustered individual categories together into the themes found in Table 4. As can be seen by this table, a quarter of the articles written by women in this study addressed technology, with a focus on uses of the World Wide Web and the Internet. Nearly a quarter of the articles addressed instructional delivery systems, with the greatest focus in this theme describing the delivery of distance education. Education/training was also a frequently cited theme and included pre-service teacher education and in-service professional development in both education and business contexts. The theme of design, development, and evaluation spanned the gamut of tasks these processes describe with no concentration in any one area. Interestingly, society, the theme that included gender, multicultural, and minority issues, was not addressed in many of the articles written by women in these journals.

Table 4 Themes and Percentages of Total Articles Written by Women

Themes	Percentages
Technology – Internet, Media, and Computer Software	25%
Instructional Delivery Systems	24%
Education and Training	15%
Design, Development, and Evaluation	10%
Society	8%
Learners and Learning	5%
Utilization Processes	4%
Research and Theory	3.7%
The Field	3%
Management	1.4%

Comparison of Findings

The themes described for this study can be compared with those of Ely (1996) and Molenda et al. (1998) found in Table 1 previously cited in this article. In concurrence with these recent studies, this study found that computers and technology are clearly the most frequently addressed topics by women writing in the field. Technology is addressed on several levels: development (software, multimedia), implementation (distance education and instructional strategies), and preparation (teacher education, continuing education, and professional development). This makes intuitive sense, as technology addresses the main focus of research in the field. More specifically, women also wrote about computer networking and applications of technology, the World Wide Web and the Internet, telecommunications, multimedia, and hypermedia. In addition, much of the content of the literature in this study focused on the uses of technology to deliver instruction, specifically in the development of distance education as a means to effectively reach a wider audience of learners.

As Ely (1996) found in his study, women are writing about the need for more training and education in the use of technology, as evidenced by the numbers of articles on professional development, teacher education, and continuing education. Many of the articles in this study addressed the integration of technology in classrooms and curriculum, specifically computer assisted/computer based instruction and web-based instruction and the use of expert systems. Similar to Molenda's et al. findings (1998), the women in this study addressed how best to instruct students, with a focus on authentic, learner-centered activities, instructional strategies that support active and interactive learning and problem solving. Women in this study addressed the integration of technology in education and the effects of technology as a way of moving education reform and meeting current needs for meeting teaching and learning standards.

Contrary to Molenda's findings (1998), articles in this study rarely addressed policy or advocacy in the use of technology nor did they write about management issues. An examination of the roles of women in the field might explain this lack of focus. How many women are in management and administrative positions where policy is addressed? The women in this study rarely cited instructional systems design (ISD), or research paradigms, methodology, or theory. Are women's articles more practitioner focused than others? How does this lack of articles reflect the discriminatory notion that women are not suited to abstract thinking? This study revealed no articles addressing the role of computers or technology in homes or communities. Is this a counter reaction to women's traditional place in the home and community and outside of the professional technological arena? Unlike Molenda's findings, there was no strong focus on authentic assessment, although there were articles that addressed assessment in general.

There were several surprising omissions found in the content analysis of these articles. Unlike Ely's and Molenda's previous studies the articles analyzed here did not address the more traditional audio/visual media. The articles included in this study tended to describe technology with an uncritical gaze, without reflection on theoretical frameworks or critiques. Finally, given the statements of concern voiced by many feminists as to the gender inequity in the field, this was not a concern that was addressed by many of the authors in this study (11 articles, 1.5%). Comparing this figure to previous findings of 2% (Foley et al., 1994), there is no real change and in fact a slight decrease in the percentage of articles regarding gender issues. Yet others (Bryson & de Castell,1995; Damarin,1994; Henderson,1996; Knupfer,1997) are writing about gender bias and the design and applications of technology, indicating the issues are not resolved in the field. The omission of gender issues in the literature points to a gap of knowledge that needs to be addressed more frequently. While in general gender issues are seen to be part of women's domain of concerns, women in the educational/instructional technology show slight interest in developing our awareness of these issues in the field.

Conclusion

Nearly all of the journals cited in this study had annual percentages of 50% or more articles written by women. This marks great improvement over past studies and recognizes women's contributions to the field. However, it should be noted that despite these aggregated annual statistics there were individual issues of journals that contained no contributions by women. There were some similarities between the topics of articles described by Ely and Molenda et al., however there were some striking differences. A curious ancillary finding of this study is that only 1.5% of articles written by women addressed gender issues and technology. This finding correlates to the previous study by Foley et al. (1994) where 2% of the articles written by women addressed gender. Questions arise as to why this is not a more pervasive theme of women's contributions to the literature.

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AECT Needs Survey, 2000

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Abstract

The purpose of this study was to determine the needs of AECT members. A total of 590 individuals completed a web-based survey after receiving an e-mail invitation from AECT. This survey was active between October 30 and November 10, 2000. The survey was categorized into three parts: demographics; publications; and conference. Resulting data was categorized, coded, and compiled. The study yielded five major findings. First, more than half of the respondents are affiliated with higher education. Second, the AECT conference is important to members with or without a trade show. Third, restructuring efforts are incomplete. Fourth, respondents noted communications problems in the organization. Fifth, online services need to be improved. Improved communication within the organization is imperative.

Purpose of the Study

In order to determine needs of AECT members and to identify the association's strengths and weaknesses, we conducted a survey. We have shared the results of this study with AECT leadership and now summarize the findings for AECT members in order to provide feedback on recent changes in the association, and to help guide decisions about AECT's future.

Research Questions

Seven research questions were investigated in this study:

1. What services does AECT provide well?
2. What are the needs of AECT members?
3. How satisfied are the members with the quality of AECT publications (*TechTrends* & *ETR&D*)?
4. How satisfied are the members with the AECT online conference registration service?
5. What conference networking opportunities are helpful to members?
6. How important is the trade show at the conference to members?
7. How satisfied are the members with the decision of restructuring and renaming divisions?

Method

Instrument

We interviewed the current Executive Director of AECT in October, 2000. He shared a list of questions that, after discussion and clarification, were incorporated into the list of questions included in this needs analysis survey. We also used two questions from the 1999 member needs survey to see how members would respond to the same questions. Then we designed the sixteen-question survey which included three demographic questions, five five-point Likert-type scale questions, four multiple choice questions and four open-ended questions.

Participants

AECT maintains a database comprised of members and individuals who subscribe to the periodicals published by AECT. E-mail was sent to 3084 names in the database, of whom 1846 of were members as of November, 2000. The e-mail message invited individuals to complete an online Web survey.

Data Analysis

We ended the survey on November 11, 2000, and prepared both quantitative and qualitative data files for analysis. After examining the data, our team discarded 15 responses from the total number to eliminate multiple responses by individuals; and this yielded 590 member and nonmember unique responses to the survey. We analyzed the quantitative data that were generated by multiple choice and five-point Likert-type scale questions by SPSS. Then we conducted a content analysis with the qualitative data generated by open-ended questions.

The following paragraphs describe how we defined categories for open-ended questions.

Question 4. What does AECT do for you now that you find most beneficial?

In response to the question of what respondents felt was the most beneficial aspect of AECT, respondents' comments indicated 8 categories of responses.

Responses that mentioned written journals, *ETR&D*, or *TechTrends* were placed in the category of "Publications". Typical comments from this category include the following:

- *AECT keeps me informed of the most recent findings, studies and research.*
- *These present broader views and information that I would have trouble finding elsewhere.*
- *TechTrends*

Responses that mentioned any aspect of the national conference were placed in the category of "Conference". Typical comments from this category include the following:

- *The annual conference is the most beneficial part of AECT. As a media/info-tech administrator I always am able to get GREAT information that I can apply when I return home.*
- *The national conferences were always of value in helping one understand new theories, techniques, and ways in which to use media in the teaching and learning process.*
- *Annual Conference*

Responses that mentioned any aspect of social or professional interaction, whether as part of a conference, presentations, or informal gatherings outside of the conference were placed in a category named "Networking". Typical comments from this category include the following:

- *Networking with colleagues and diversity of programming when it is good.*
- *Provides a venue for the exchange of knowledge and/or research in our field. Also provides opportunities to network and interact with colleagues.*
- *Provides contacts with colleagues, old and new, which leads to opportunities to visit and work at institutions outside the U.S.*

Responses that mentioned any aspect of professional improvement, current issues, trends, or keeping up with developments were placed in the category entitled "Professional Development." Typical comments from this category include the following:

- *Keep up with latest development in educational technology.*
- *AECT helps to keep me updated as to what is current in the field.*
- *Keeps my coworkers up to date on current issues and trends.*

Responses that mentioned any aspect of electronic communication through the Internet or the World Wide Web, email or listserv communications were placed in the category entitled "Web Services". Typical comments from this category include the following:

- *The job postings site is most useful.*
- *The Website is useful. I get most of the information from the AECT Web.*
- *listserv newsletter.*

Responses that included the concept of employment-related issues were placed in the category of "Employment Information." Typical comments from this category include the following:

- *It provides employment leads.*
- *Job listing (when current).*

Responses stating that the respondent does not like some general aspect of AECT were placed in the category entitled "Negative". Typical comments from this category include the following:

- *At this time nothing. Several years ago the journal and conference provided good opportunities for learning.*
- *I do not currently benefit from AECT.*
- *I have found nothing of value the last two or three years…the organization has been in transition and cannot function until the transition is complete.*

Responses that did not fit into any of the categories that had been established for this question were placed in one category that was entitled "Others". Each of the responses could possibly make its own category and stand alone in this report, but our research team felt that they should be joined in the "Other" category. Typical comments from this category include the following:

- *The membership is diverse, freeing me from the parochial view of one section of the profession; participation in the organization and its governance is encouraged (most national organizations discourage it with red tape); the people are wonderful, supportive and generous with their expertise; the summer leadership institute is excellent.*
- *Phil Harris, with his staff, and the AECT President and Board of Directors are actively looking for ways to support and encourage the AECT International Student Media Festival. Charles White shares the vision of ISMF that it serves as a natural introduction to AECT for teachers and students interested in the role of media in education.*
- *TechTrends, copyright issues, new products, how a new technology works in real situations. Ed issues and On-line classes. New topics on Internet usage. Teacher training.*

Question 5: Please list the most important thing AECT should be doing for you now that it does not currently do.

In response to question five in which respondents were asked what it was they felt was the most important thing that AECT should be doing that they were not currently doing. Member comments separated into 7 categories of responses. Responses that indicated some kind of need that was associated with the AECT National Conference were placed into the category entitled "Conference". Typical comments from this category include the following:

- *Thought that the lack of exhibits at national conferences was big weakness, but that will be satisfied in Denver, I assume. Organization is now doing, or about to do, most of the things that I think a national professional organization should do.*
- *I would like to participate in a conference but time, location, and funding are an issue. I would like to see AECT sponsor an online conference or include online conference participation at its f2f conferences.*
- *Providing a scholarly conference that is respected and has credibility. Provide timely information on topics relevant to our field.*

Responses that included a mention of communications, response or lack of response to submitted questions, or a flow of information were put into the category entitled "Communications". Typical comments from this category include the following:

- *Communicate with members better. I sent in my membership months ago, and I've started receiving pubs, but I don't remember receiving any acknowledgment of my membership. I was wondering about it until I started receiving TechTrends.*
- *Create a clear link of communication between the members and administration so members can become more involved in policy and know what to expect from one conference to the next.*
- *Provide data/opportunities/support for better communication throughout the year.*

Responses that mentioned publications, articles, *ETR&D, TechTrends,* or journals were placed in the category entitled "Publications". Typical comments from this category include the following:

- *AECT should be continuing to publish a scholarly journal. I have not yet received an issue of ETR&D.*
- *More publications.*
- *AECT journals need to improve their quality of articles. Emphasize research-based reviews of educational technology uses in the classroom to help K-12 teachers in implementing technology in the classroom.*

Responses that referenced electronic material including websites, listservs, electronic communications, or email were placed in a category entitled "Web Services." Typical comments from this category include the following:

- *Message board or listserv for ongoing member interaction/discussion.*
- *Provide me with the electronic capability to reach out to my state people and to other colleagues individually and updating me electronically on the state of the organization. Our name says communication and technology or, communication through technology.*
- *Access to electronic materials e.g. back issues of journals etc.*

Responses that included a discussion of the restructuring efforts, organizational efforts, or changes within the AECT were placed in a category entitled "Organizational Restructure." Typical comments from this category include the following:

- *Restructure organization so it can best serve its members (e.g. conference coordination, quality control of its publications, etc.).*
- *Be more organized and professional.*
- *Provide a viable organization that combines 'clout' with an outlet for academic research.*

Responses that indicated a need for development of professional skills or services or for keeping up with trends were placed in a category entitled "Professional Development." Typical comments from this category include the following:

- *Providing a sense that this organization is keeping up with the latest trends in instructional design throughout the year.*
- *More professional development activities on the regional level.*
- *Professional Development. I know many people are involved in the leadership and other efforts within AECT, but I don't know how to get into that 'inner circle.' I've always felt like an outsider, except for participation in the annual conference.*

Responses that noted single instances of a suggestion were sorted into the category entitled "Other". There was no discernible trend noted in this category, and so they were combined into a single category of suggestions. Typical comments from this category include the following:

- *Role of Media Specialists in the changing school environment.*
- *Continue to seek member involvement in ways like this.*
- *Uncertain what it could do for me since I'm a bit away from the center of things and haven't been able to attend a conference for several years. Mainly – just keep information coming.*
- *I am not aware of services that would be beneficial for me that I am not getting from somewhere else that AECT should provide.*

Question 15. How did you first become aware of AECT?

In response to the question of how respondents first became aware of the AECT, comments were sorted into 6 categories of responses. Responses that indicated the individual had first learned about the organization while attending a graduate program or that they had learned about the organization in graduate school were included under the category entitled "In Graduate School." Typical comments from this category include the following:

- *From faculty members during graduate school.*
- *As a graduate student some 35 years ago….*
- *Through discussion with faculty in graduate school.*

Responses indicating that initial awareness of the AECT organization had come from contacts with professional colleagues and peers were grouped under the category "From Colleagues and Peers." Typical comments from this category include the following:

- *Fellow professionals.*
- *Recommended by my colleagues.*
- *My father has been a member for many years, and then when I entered the field, my boss was a member.*

Responses from individuals who named a variety of different sources that did not fit easily under existing categories were grouped under the category entitled "From Various Sources." Typical comments from this category include the following:

- *As a beginning professional by attending a regional conference…*
- *Link from another web site*
- *In 1980 we hosted the then active Missouri Affiliate in Cape Girardeau MO. I have been a member ever since.*

Responses from members who had been a part of the organization for such a long period of time that they couldn't remember the original exposure to the organization were included under the category entitled "Cannot Remember." Typical comments from this category include the following:

- *Don't remember…*
- *Don't recall…*
- *…I don't remember how I became aware of it.*

Responses from individuals who first learned of the AECT by means of written publications or journals are organized under the category entitled "From Publications."

- *learn from TechTrends and join by mail.*
- *In search of publication outlet.*
- *Via periodics (sic) at University's library.*

Responses from individuals who had first learned of the existence of the AECT while attending an AECT conference are included under the category entitled "At the AECT Conference." Typical comments from this category include the following:

- *Convention in Miami in 1979.*
- *Through exhibits at the WEMA conference in Wisconsin.*
- *Really got involved after attending an AECT Region 6 leadership conference in 1981…*

Question 16. Please list any other comments that would benefit the AECT leadership in determining future directions.

In response to the invitation asking respondents to list any general comments that would benefit the AECT leadership in determining future directions, respondents' comments were sorted into 11 general areas. Responses that indicated the AECT needs to focus efforts in the restructuring process were reported under the category entitled "We need to define AECT's focus." Typical comments from this category include the following:

- *AECT must clearly define its purpose. Direct activities to that purpose. Make its membership services supportive of that purpose.*
- *AECT needs to decide who its members are and provide opportunities for those members to meet…*
- *Find your niche, and stick to the knitting. Don't try to be all things to all people, which the old AECT never learned. Based on what I see in the new division structure, I'm not sure AECT has learned it yet.*

Responses that spoke of perceived communication difficulties between the administration of AECT and the membership were grouped under the category entitled "AECT needs to improve communications with the membership." Typical comments from this category include the following:

- *Please have someone available at the telephones at the office. I have tried to reach a person on several occasions and only left messages which were not returned.*
- *To strengthen AECT membership, I believe AECT should acknowledge its members by sending a membership card…*
- *There appears to be no way to become involved in the governance and workings of AECT without 'knowing someone.' Please promote opportunities for people to become involved in the divisions and councils or in planning the conference.*

Responses that indicated problems or solutions to difficulties encountered during attendance at the national conference are grouped under the heading "Conference needs improvement." Typical comments from this category include the following:

- *…improve the organization of the conference. I overheard several people commenting on how unorganized it seemed to be….*
- *The program needs to be better organized. Denver was a mess with sessions listed in one place, changed in the addendum in another, and shown on the TV monitors in a third….*
- *…I go to this conference because of its diversity – which was down a good bit this time. Frankly, it has overpriced itself at this point. I would not have attended this conference at this price if I were not involved in governance areas.*

Responses that indicate problems or issues that have been apparent within the AECT website are included under the category entitled "Website needs improvement." Typical comments from this category include the following:

- *…keep the WWW site up-to-date (online job listings are great…member directory on-line would be nice).*
- *Please, please upgrade the website…*
- *The AECT website needs some dramatic fixing by people who know good graphic and user-interface design and good content editors….*

Responses of a broad nature that addressed very specific circumstances and yet were unable to be grouped with other responses formed a category entitled "Miscellaneous." Typical comments from this category include the following:

- *I joined AECT as a graduate student and attended conventions. At the 225 dollar price of Denver, I as a graduate student would never have been in AECT or participated for so many years.*
- *Get great speakers instead of so many social functions. Cut the exhibits if we can't get enough vendors to make it worthwhile. Confirm all presenters in advance. Cut the costs if possible.*
- *We MUST have a better process for letting people know if their papers were accepted. We did not find out until we got the program in Denver that one of ours was accepted.*

Responses from individuals who expressed a general sense of pleasure with the organization are grouped under the category entitled "Pleased with AECT." Typical comments from this category include the following:

- *I am glad to see that AECT is moving forward again.*
- *Keep up the great work…*
- *AECT still has an important role to play in the evolution of technology-based education/training, but perhaps not as an independent society any longer. A merger with AACE or ISPI may be necessary to accomplish what's needed.*

Responses from individuals who expressed their appreciation of the fact that AECT conducted this survey to determine the interests of AECT members are grouped in the category entitled "Like the survey." Typical comments from this category include the following:

- *Can't think of anything...this strikes me as a good survey.*
- *I am pleased to see this survey being done -- it speaks well for the leadership.*

Responses from individuals who felt that AECT was not strong enough in getting positive aspects of the AECT program out to the attention of the membership are included in the category entitled "Marketing needs improvement." Typical comments from this category include the following:

- *Some steady, dependable "marketing" will be needed.*
- *Are you marketing AECT to the school districts? Is AECT represented at library and technology conferences? I do not recall seeing it at those I attend. I hope this helps. Thank you for all the support I have received through AECT.*

Responses from individuals who feel that the general leadership of the AECT has diminished over time and that it needs to be asserted are included in the category entitled "Leadership needs improvement." Typical comments from this category include the following:

- *I want AECT to resume a strong leadership position once more in the field of education & communications technology.*
- *We need to have divisions take a strong leadership role overall and in conference planning specifically.*

Responses that mentioned *ETR&D*, *TechTrends*, or other journals were grouped under the category entitled "Publications." Typical comments from this category include the following:

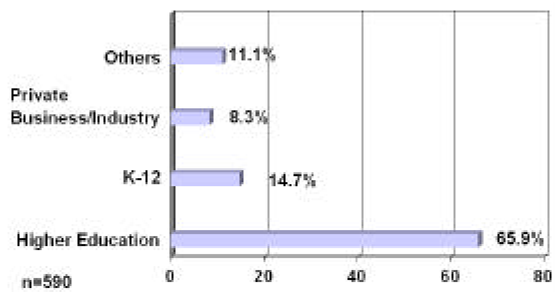
I think ETR&D should publish more variety and a larger number of articles. For example, it should cover more articles related to network-based learning or Web-based learning.

I think we should have more publications, and that we should start a research mentoring program. Also, I would like to see a new journal that focuses on on-line learning. That journal could be on-line.

Findings

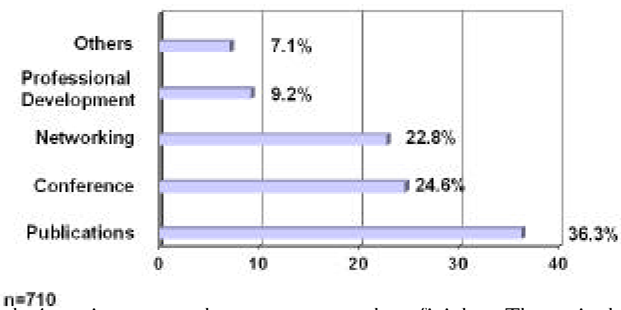
Of the 590 respondents, 487 (82.5%) respondents reported being current members, 47 (8%) respondents reported not being current members and 56 (9.5%) respondents were not certain whether or not they were members ("Not Sure"). With respect to whether or not the respondent resides in the U.S., 563 (95.4%) respondents stated that they reside in the United States while 27 (4.6%) respondents reported residing outside the U.S.

Question 3: What is your employment setting?



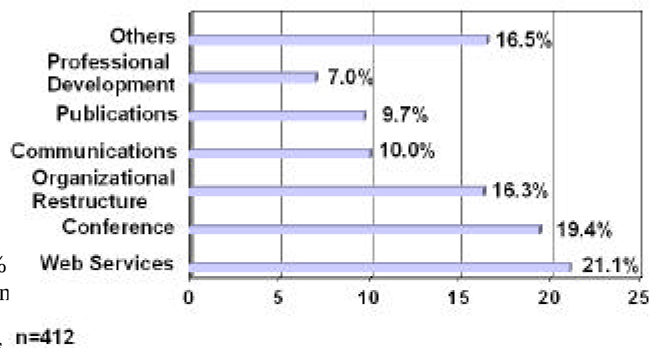
- Approximately two-thirds of the respondents reported Higher Education affiliation, which includes junior/community college or technical institute, college or university campus, or graduate student.

Question 4: What does AECT do for you now that you find most beneficial?



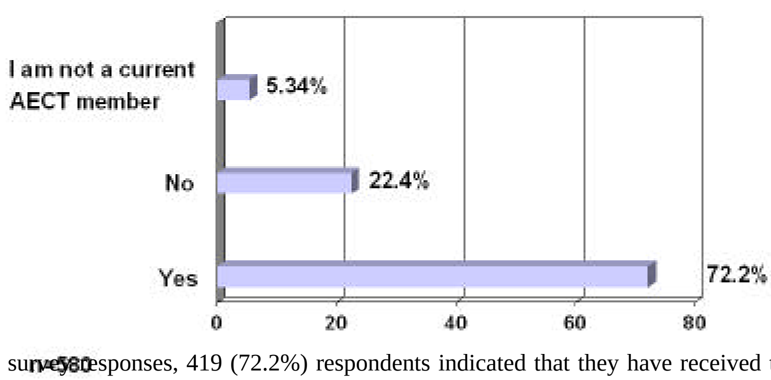
- Respondents identified 4 major areas that were most beneficial. These include Publications, Conferences, Networking, and Professional Development.

Question 5: Please list the most important thing AECT should be doing for you now that it does not currently do.



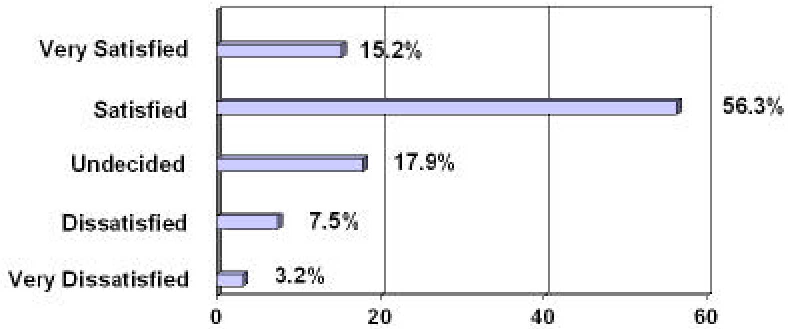
- Approximately 57% … at organizational restructuring as the most importan … ime.

Question 6: AECT publishes the following journals-*Tech Trends* and *ETR&D*. Have you been receiving your publications in a timely manner?



- Of the 580 survey responses, 419 (72.2%) respondents indicated that they have received the publications in a timely manner. It is interesting to note that 31 respondents chose the item" I am not a current AECT member."

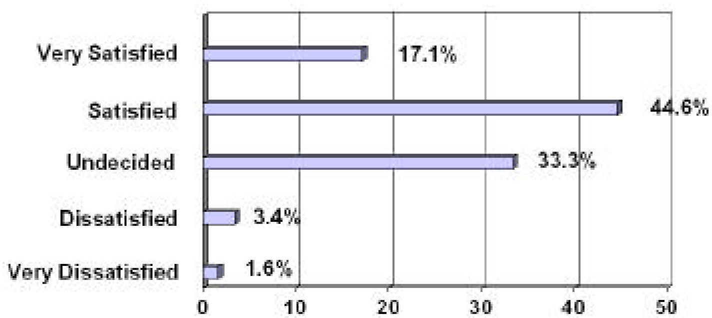
Question 7: How satisfied are you with the quality of recent attitudes in Tech Trends?



n=560

- Of the 560 survey responses, 400 (71.5%) respondents expressed satisfaction with the quality of recent articles in *TechTrends*. There were 60 respondents (10.7%) expressed some degree of dissatisfaction with the quality of *TechTrends.*

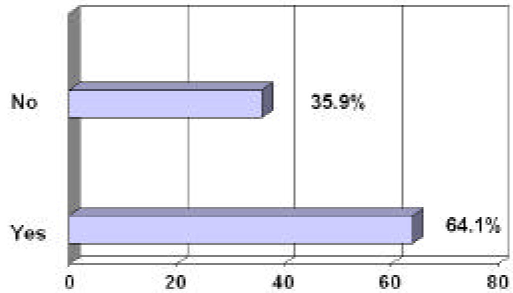
Question 8: How satisfied are you with the quality of recent attitudes in *ETR&D*?



N=439

-
- Of the 439 survey responses, 271 (61.7%) respondents exp ressed satisfaction with the quality of recent articles in *ETR&D*. There were only 22 respondents (5%) who expressed some degree of dissatisfaction with quality of *ETR&D*.
- Approximately one-third of the respondents indicated that they were undecided with regard to their satisfaction of qualities in *ETR&D*.

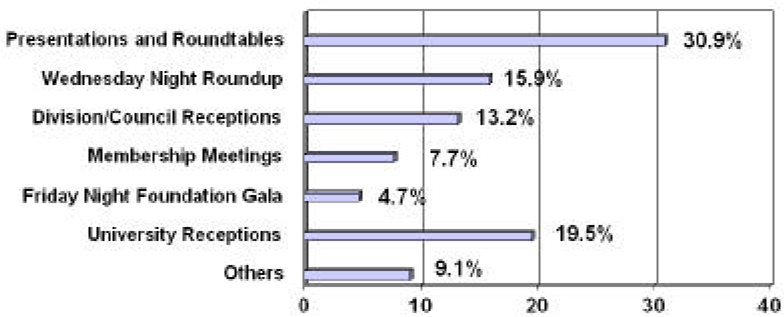
- **Question 9: Have you attended an AECT National Conference within the past 3 years?**



N=585

I

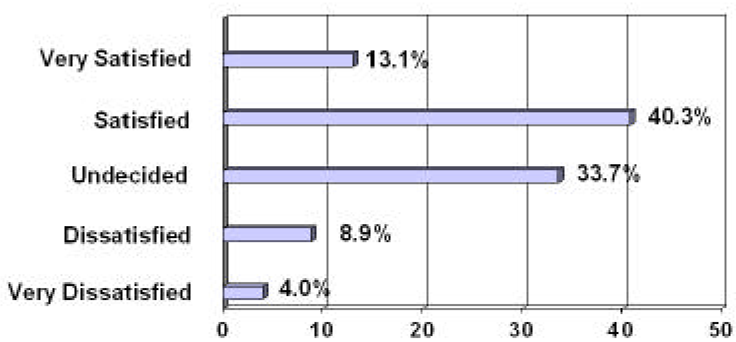
If YES, please indicate which of the following were helpful for meeting people (i.e., networking)?



N=1000

- Respondents addressed the question of what was the most important thing that AECT could do to promote meeting people, the concept of networking with others. Four networking opportunities stood out from the responses, and these included meeting people at presentations and roundtables, the Wednesday night Roundup (AECT Reception at the conference), Division and Council receptions, and University receptions.

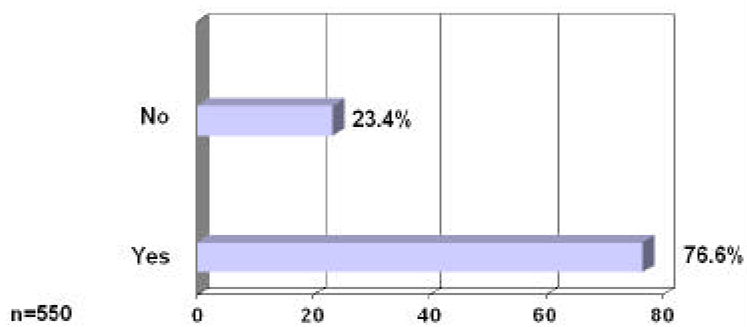
Question 10: Were you satisfied with the new online AECT Conference registration service available through the AECT web site?



N=404

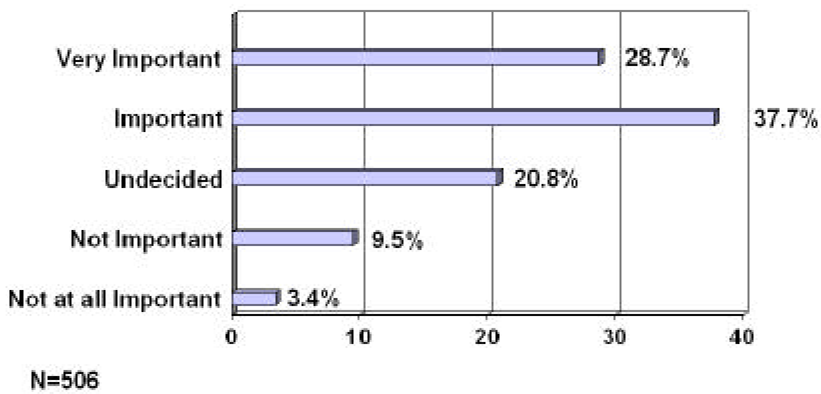
- A total of 216 (53.4%) respondents expressed some degree of satisfaction with the online registration.
- Note that almost a third of respondents were undecided with respect to their satisfaction with the online registration service.

Question 11: AECT changed its conference date from early February to late October, in order to meet concurrently with the National School Board Association, so that AECT members could visit the large trade show. Do you agree with this decision?

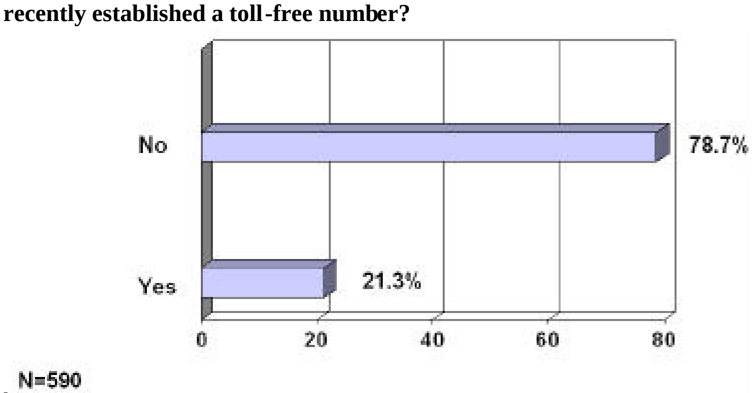


- There was a ratio of approximately three to one among respondents who agreed with the decision to change the date of the AECT conference so that it met concurrently with the National School Board Association (NSBA).
-

Question 12: How do you feel about the trade show at the AECT Conference?

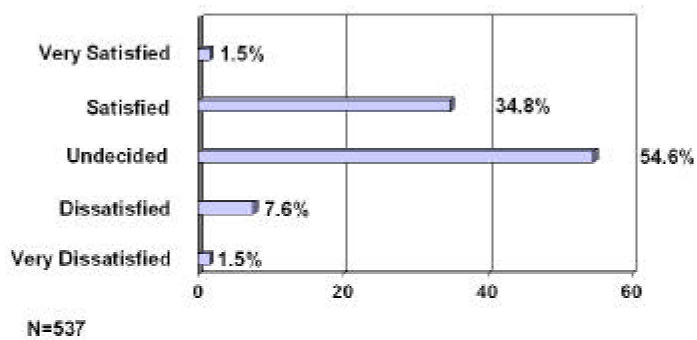


- 336 (56.4 %) respondents believed that the trade show is important or very important. **Question 13: Do you know that AECT has recently established a toll-free number?**



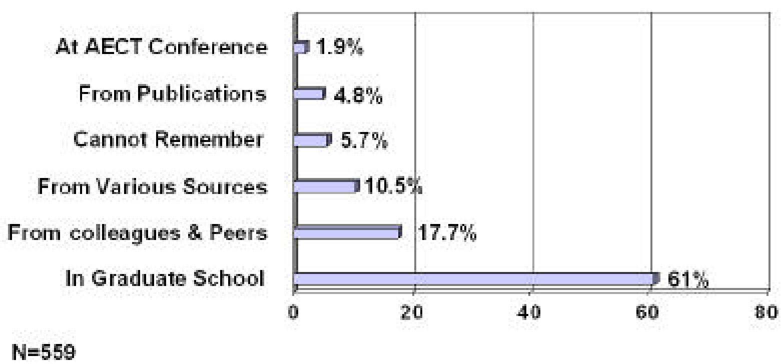
- More than three-fourths of respondents were not aware that the AECT had obtained a toll-free number.

Question 14: AECT made the decision in 1999 to restructure and rename divisions and councils. How do you feel about that?



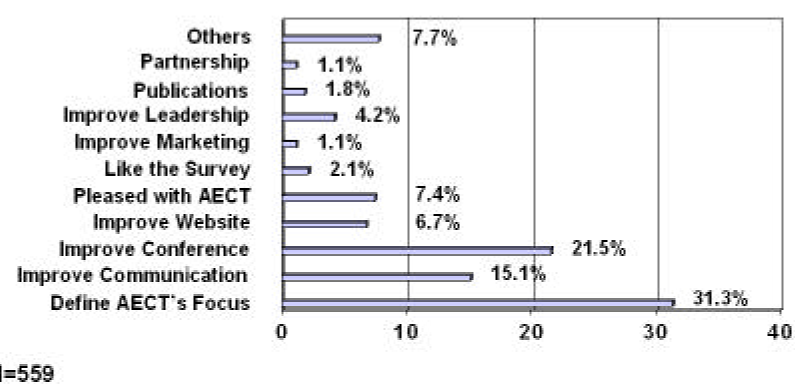
- A total of 195 (36.3%) respondents expressed satisfaction with the restructuring efforts. This included 187 (34.8%) respondents who were satisfied and 8 (1.5%) respondents who were very satisfied. It is important to note that a greater percentage of respondents expressed some degree of satisfaction with the restructuring (36.3%) than those who expressed some degree of dissatisfaction with the restructuring efforts (9.1%). A slight majority of respondents expressed neither satisfaction nor dissatisfaction with the restructuring efforts.

Question 15: How did you first become aware of AECT?



- The greatest percentage (61%) learned of the organization from their graduate school experience, and 116 of those respondents heard of AECT directly through a graduate school professor.

Question 16: Please list any other comments that would benefit the AECT leadership in determining future directions.



- Respondents were given the opportunity at the end of the survey to express themselves on any topic that they felt was beneficial to the organization. The largest group (31%) felt that defining AECT's focus is mission critical.
- 15% of respondents felt that AECT needs to improve communication with its members and 22% of respondents felt that improvement is needed in the AECT national conference.

Discussion

Higher Education

It is important to note the fact that more than half of the respondents are affiliated with higher education at the community college and university level. Of the K-12 respondents to this survey, they often found that there was little of value for them at the trade show in conjunction with the conference. As AECT continues the restructuring process, it will be important to determine the role of K-12 members in the organization. If the association wishes to include the K-12 members in a significant manner, they must examine methods to do so. It is clear that the organizational emphasis is currently on providing services to the majority of their membership, which is involved with Higher Education as evidenced by this survey.

More than half of the membership of AECT joined because of an introduction that occurred during their work in graduate school. Of this, about a third mentioned that they had first heard of the AECT through their professors. AECT's efforts at getting out the word in the graduate schools that teach courses having a technology base seems to pay off in increased membership. Anything that AECT can do, such as giving breaks to graduate students for conference participation or membership, is likely to realize a benefit for the organization as a whole later on.

Conference

AECT members state that they found the conference to be the second greatest benefit of membership. The conference was also stated to be the second highest service that AECT offered requiring improvement. Members were vocal in offering remedies for the conference, and AECT administration would be well advised to examine these comments thoroughly.

Communication

An issue that emerges clearly across all of the survey questions is the issue of communication between the administration of AECT and the membership of the organization.

The issue that is mentioned most often is the frustration of individuals who are unable to receive a response to queries for information. A good example of this is the fact that 9.5% of the individuals to whom this survey was sent were uncertain of their membership status. AECT uses time and resources to contact the individuals who are a part of their database, and it is strongly suggested that they clarify this situation at the earliest opportunity.

Most people were pleased with the online registration services that were available for the conference. There were some important exceptions noted. Of the respondents who mentioned that a purchase order was needed so that their sponsors could pay for registration, it seems that such a service was not offered. Additionally, concern was expressed about the security of the web site and people were uncertain that their personal information would be kept in confidence. AECT might consider explaining the security issue in future registration offerings to address these concerns.

A final issue exists with respect to the online services area. Concern was expressed that the AECT should be a leader in the field of website technology, and many felt that the current website was lacking in information, design, and services. It was mentioned that AECT should spend resources to see that the website would address these issues in a state of the art manner so as to present a model website to the world.

Most people did not know that the AECT has a toll free number. If the Association wants this number to be highly visible, they must consider placement of the number in a visible manner through all of the ways that they contact the membership. This would include the website, email communications, journals, and personal communications.

Publications

AECT publishes two journals, *TechTrends* and *ETR&D*. The first is available with membership and the second only by special subscription. This must be thoroughly explained to all who receive these publications. There was some confusion about these journals at time of this study. Further, publication and delivery of the journals in a timely manner should be a priority to the organization.

Leadership

The task of restructuring AECT to better meet the needs of the membership is not complete, and efforts in this area need to continue. It is essential that restructuring efforts be communicated to the membership of AECT and that the membership must become more actively involved at more stages in the restructuring. If it is at all possible, AECT administration should initiate a quality control action aimed at assuring members that their needs are being addressed.

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Software Developers' Attitudes Toward User-Centered Design

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Abstract

The concepts of usability and user-centered design (UCD) have grown in popularity over the past 20 years as measured by the number of research and mainstream articles devoted to their discussion. As with all new developments, however, there is always the question of how things work in practice compared to theory. A survey on 83 software developers mostly in small-to-medium sized companies in a variety of industries was conducted to examine software developers' views on UCD and usability practices and to illuminate how current practices relate to theory. Results of a descriptive analysis of the 22 Likert-scale attitude question items suggested that respondents had moderately positive attitudes towards UCD activities and discipline. The Likert-scale items were subsequently factor-analyzed and the results suggested that the respondents tended to agree that UCD is worth the effort and cost. They also tended to agree that it is important to conduct many use test sessions and they learned a lot about their products from user test sessions. Software developers who reported that their companies followed important UCD practices were more likely to agree with the view that UCD is worth the effort and cost. Those who have attended usability test sessions were more likely to agree that user test sessions are valuable, and that UCD is worth the effort and cost. However, those who have attended usability test sessions also were more likely to agree that UCD is more work and costs more than conventional development activities. Also, significantly more good usability practices were reported by software developers who worked on teams that either hired usability consultants or had a usability specialist on their teams compared with those who had no usability specialists at all. While software developers held positive attitudes towards UCD, it was notable that they did not report that their companies used practices that are central to UCD. It appears that, while many software developers agree that UCD is a good idea, it tends not to be implemented fully in practice.

Introduction

The concepts of usability and user-centered design (UCD) have grown in popularity over the recent 20 years as measured by the number of research and mainstream articles devoted to their discussion. As with all new developments, however, there is always the question of how things work in practice compared to theory. The opportunities for UCD to have a significant impact on the rapid developments in information technology are infinite in number and will only increase as new technologies emerge. To ensure that this impact is realized, however, organizations must understand how to best organize themselves and their practices to take full advantage of what UCD has to offer.

The purpose of this study is to examine software developers' views on UCD and usability practices in order to illuminate how current practices relate to theory. The results of this study will help researchers and organizations understand what factors are critical to integrating an effective UCD approach in the development lifecycle.

Defining the Concepts

User-centered design is an approach to product development that emphasizes keeping the end user "front and center" throughout the product development process. Unlike the specific techniques and methods that make it up, UCD is a philosophy toward designing products (Norman, 1988), the underlying theme of which is that developers who stay attuned to the concerns, thought processes, habits, and preferences of the people targeted to use their products will develop interfaces and services that are easier to use, have greater utility, and are more enjoyable for their customers (Rubin, 1994).

If UCD is the philosophy that guides an effective development process, usability may be seen as the end result. Once known simply as "user-friendliness" (Norman & Draper, 1986), the concept of usability has attracted much attention over recent years and is currently considered to consist of the following five attributes: (a) learnability, (b) efficiency, (c) memorability, (d) errors, and (e) satisfaction (Nielsen, 1993).

Perhaps one of the most valuable tools in the designer's UCD toolbox is usability testing. This method affords the design team the unique opportunity to observe the actions of the target user population first-hand. Usability testing allows designers to observe authentic users performing authentic tasks and scenarios. While many tests occur in a laboratory environment to make observation and data collection easier, field visits to the users' actual workplaces provide the additional benefit of an authentic context as well.

Dumas and Redish (2000) identify five characteristics that define usability testing:

1. The primary goal is to improve the usability of a product
2. The participants represent real users
3. The participants perform real tasks
4. You observe and record what participants do and say
5. You analyze the data, diagnose the real problems and make recommended changes to fix those problems (p.22).

The Importance of "Getting Close" to Your Users

The activity of "requirements gathering" has long been a core element of the software design process (Boehm, 1988), yet critics of poorly designed software point out that gathering requirements through focus group discussions or by talking to management often fails to identify what is needed to make a usable product. The only way to accurately define what people will be able to use is to gather information *directly from the users themselves*. As with so many things in life, however, all user-centered design activities are not created equal. Some methods are more successful than others at bringing users and designers close together.

It would seem that the simplest way of gathering information from users is to ask them what they want. Unfortunately, we know that users do not always know what they want. Indeed, Andre & Wickens (1995) cite a host of studies demonstrating that users not only don't know what they want, but that they frequently make bad choices as well. In one study of six different interface designs, users consistently indicated a preference for those designs that they performed most poorly on (Bailey, 1995). The results emphasize how important it is to include empirical data on performances in addition to asking users what they like.

Conducting needs analysis interviews and performing content sorting activities with users have also been found to bring users and designers closer together (Corry, Frick, & Hansen, 1997). These activities have the added benefit of being able to be performed early in the design process, allowing multiple iterations to follow.

Low-fidelity or paper prototyping is a technique that involves users early in the design process (Sugar & Boling, 1995) and has been shown to be just as effective as prototyping exercises that employ a more completed electronic version (Virzi, Sokolov, & Karos, 1996). The fact that paper prototypes of a computer system interface are obviously unfinished allows users to freely comment and contribute their ideas for improvement to designers (Datz-Kauffold & Henry, 2000).

Testing electronic prototypes or even an fully functioning system has certain advantages over low-fidelity prototyping. On-screen interactions no longer need to be simulated and colors, resolution, modes, and system operating speed can be evaluated more accurately. Misanchuk, Schwier, & Boling (2000) describe how usability testing the working version of an electronic book on instructional multimedia led to the discovery of multiple, desirable features that were missing.

Often, there are factors affecting usability that cannot be observed in a lab or test environment. Contextual inquiry (Beyer & Holtzblatt, 1998) attempts to overcome this problem by having designers observe users in their natural work environment in order to fully consider the many variables that may influence how a product is ultimately used.

Inviting users to participate on the actual design team is another strategy for bringing users and designers close together. Known as participatory design, this approach typically has designers and users work side by side throughout the development cycle. Benefits of participatory design have been shown to include a sense of ownership among users and an increased understanding of users by designers (Williams & Traynor, 1994). Clement & Van den Besselaar (1993) stress, however, that for participatory design efforts to succeed, users must be allowed to take an independent position on problems and they must participate in the process of decision making.

The Current State of Practices and Attitudes

While much has been studied and written regarding usability evaluation methods and design practices, very little work has been done in determining actual practices and attitudes of those in industry. Gould & Lewis (1985) surveyed 447 software developers attending a human factors workshop to see whether they identified three basic principles of designing for usability as a common part of their own design processes. The principles included an early and continual focus on users and tasks, empirical measurement, and iterative design. The results revealed that developers either did not identify with the three principles or did not understand them well enough to implement them as intended.

In another survey of current practices at the time, Dillon, Sweeney, & Maguire (1993) conducted a survey of the software industry in the United Kingdom, gathering data on four themes: respondents' backgrounds, their interpretation and appreciation of the concept of usability, current practice with regard to usability evaluation, and problems and requirements for support in conducting usability evaluations. The authors found a widespread awareness of usability among respondents, but what seemed to be only a superficial application of Human Factors methods.

Differences in attitudes toward usability were considered in a study that combined survey and qualitative interview research of three Management Information System (MIS) managers and 125 end-users of commercial software systems (Morris & Dillon, 1996). Interviews with the managers revealed an emphasis on costs and system features when designing or selecting new technologies for their organizations. This was in significant contrast to users' main concerns of contextual and environmental issues that affect the software's usability.

Methodology

The following questions were considered during the course of this investigation: What are software developers' attitudes toward user-centered design? What are the actual methods utilized by software developers who report using UCD? Does there exist any correlation between the practice of user-centered methods and developers' attitudes?

Data Collection

Three survey forms were sent to each of 500 software companies (1,500 forms). The companies that the survey forms were sent to were selected from the Software Publishers Association membership directory. The survey forms were comprised of questions concerning the respondents job classification (type of software designer), type of training (if any) in usability, history of participation in usability tests, types of usability procedures utilized by respondents, size of the company the respondent worked for, and attitudes concerning usability testing. Most of the questions required respondents to check boxes indicating the appropriate answer, except for the attitude questions which contained 22 question items measuring the subjects' response to a given statement. These items were measured on a five-point Likert scale from strong disagreement to strong agreement.

Subjects

Eighty-three software developers responded to our survey. This was an effective return rate of 5.5 percent.

Results of the Study

Descriptive Analysis for Software Developers' Current Practices of UCD

(1) Respondents' Position as a Software Developer

As shown in Table 1, the majority of respondents worked in commercial applications, instructional software, and entertainment software. Software developers who belonged to the above three positions accounted for 86 percent of the respondents.

Table 1. Software developers' Position

Position	Frequency
Commercial applications	33
Instructional software	24
Entertainment software	14
Other	9
Technical/programming language	1
Instructional and Entertainment	1
Online and Commercial	1
Operating systems	0
Online documentation/help	0
Total	83

(2) Companies that Participated in the Survey

Among the 500 companies to which the mail surveys were sent out, results were returned from 56 different companies. Most of the companies participated in the survey had one person respond; whereas 17 companies surveyed had 2-3 software developers respond.

(3) Number of Employees in the Company

More than half of the respondents (55%) worked in companies with 1-50 employees, and about a quarter of the respondents worked in companies with 51-250 employees. The remaining 18 percent worked in companies with greater than 251 employees. Thus, most of the respondents (82%) worked in smaller companies, with less than 250 employees.

(4) Number of People Assigned to Software Development Team

More than half of the respondents worked in core development teams with 4 - 8 members, and about one-third of the respondents worked on teams of 3 or less. Relatively few respondents (10%) worked on larger teams with more than 8 members.

(5) Company' Expectation on Usability in Their Products

Eighty-two percent of those surveyed reported that their company always expected their software development teams to ensure usability in their products. Seventeen percent indicated that their companies sometimes had such expectations. No respondent indicated that such an expectation did not exist in his or her company.

(6) Use of Specific Process for Incorporating UCD into Product Development

Thirty-seven percent of the respondents answered that their companies always used UCD processes in their product development, and 47 percent responded their companies used UCD processes sometimes. Meanwhile, 14 percent indicated their companies never had such a process in their software development. Thus, it can be seen that the majority of the respondents reported that their companies used specific UCD processes for software development.

(7) Experience in UCD Practice for Software Development

Respondents had an average of approximately 4 years of experience in UCD practice (M= 4.02, SD=1.70), ranging from 0 to over 7 years. More than half of the respondents indicated that they have practiced UCD 1 -7 years.

(8) Experiences in Attending User Test Sessions

For the question asking for their experiences in attending user test sessions, 80 percent of respondents indicated that they had attended at least more than one user test session. In contrast, 20 percent responded that they had never attended user test sessions. There was considerable dispersion in the reported number of times that they attended user test sessions, ranging from 1 to 100 test sessions.

(9) Experiences in Helping Conduct User Test Session

Sixty-four percent indicated that they helped conduct a user test session more than once, while 36 percent answered they never helped conduct user test sessions. Those who had conducted user test sessions themselves reported widely dispersed occurrences, ranging between 1 and 200 times.

(10) Software Development Activities Being Practiced

Respondents were asked to check all of the kinds of activities in which their companies were engaged in developing their products. These activities were ranked according to how frequently they were mentioned by the respondents in Table 2. "Using common sense" was most frequently checked (77), while "using constructive interaction techniques" was least frequently indicated (18). These activities were coded with +, 0, and – by the investigators (the respondents did not see these codes). A "+" activity means that the user is actively involved in the software development process. A "–" activity indicates that the user is not involved in the process. A "0" activity means a user is somewhat involved or neutral. The median split from Table 2 reveals that the majority of the activities above the median do not involve users in the design process (7 out of 9), and the 4 activities in which users actively participated ranked among the bottom 6 (below the median).

T*able 2. Software Development Activities Reported to Be Practiced*

Code*	Development Activities	Number of Responses
-	Using common sense	77 (top ranking)
-	Setting major goals	67
0	Using computer prototypes	65
-	Interviewing representative users and asking whether they like the product	63
-	Soliciting feedback from "seed sites" or "beta-testers"	62
-	Performing competitive analyses of competing products	58
0	Testing out major design issues with users	58
-	Following GUI guidelines	58
-	Following standard interface guidelines	56
-	Passing screen shots to other developers	50 (median ranking)
0	Using paper prototypes	44
-	Following company's interface guidelines	43
-	Expert walkthroughs	39
+	Doing field studies/visits of user's work environments	38
+	Having a real user on the design team	29
0	Performing task analysis of user's tasks	27
0	Recording user's actions with a program	25
+	Using think-aloud protocols	22
+	Using constructive interaction techniques	18 (lowest ranking)

* + indicates the user is actively involved in the software development process.
 - indicates the user is not involved in the software development process.
 0 indicates a user is somewhat involved or neutral to the development process.

(11) Attending Formal Training in Usability and Sources of Training

Less than one-third of the respondents indicated that they had any formal training in usability; the remaining 70 percent reported not having attended any formal training in usability. When asked their sources for obtaining training in usability – including informal types of training – the respondents were most likely to get their training from books/journals, and conferences/workshops.

(12) Accessibility to a Usability Specialist

Sixty percent of those surveyed answered that their development teams did not have access to usability specialists. On the other hand, 17 percent had access to usability consultants, and 17 percent had a specialist on their team; thus, one-third of respondents indicated having access to usability specialists.

Software Developers' Attitudes Towards UCD

(1) Factor Analysis

A factor analysis of the 22 Likert-scale attitude questions was conducted using the image factoring method with varimax rotation, resulting in seven factors as shown in Table 3. In addition, a reliability analysis on each factor was conducted

(Cronbach's α for internal consistency). The Likert-scale values of the items that had negative loadings on a factor were reversed when factor scores were computed. Results of the reliability analyses ranged from .5952 to .7784 (see Table 3).

Table 3. Results of Factor Analysis and Reliability Analysis

Factor	Items	Reliability coefficient
1. User-centered design (UCD) is more work and costs more.	16. My team's UCD activities tend to lengthen development time for our product. 5. The UCD activities that I have participated in did not generally add time to product development cycle.* 13. UCD is more expensive than traditional product development. 1. UCD activities make extra work for me as a developer.	α = .7784 (n = 74)
2. User test sessions are valuable.	14. Participating in user test sessions is a positive experience. 21. Overall, I do not enjoy participating in user test sessions.* 18. I usually have confidence in the results of user test sessions.	α = .7554 (n = 74)
3. Epiphany: experience of UCD changed my mind.	2. Users in the test lab behave just the way I expected them to before I started attending user test sessions.* 15. Once I became involved with UCD activities, I changed my mind about what UCD is. 17. After the first user test session I observed, I found that I had an altered view on my users.	α = .6438 (n = 59)
4. Learned little from user tests and UCD.	3. User test sessions usually do not give me new insights about my program. 11. Participating in UCD activities had little effect on my understanding of this discipline.	α = .5952 (n = 67)
5. Many tests important, learned a lot about my product.	10. It is important to conduct user test sessions many times throughout product development. 12. I usually learn a lot about my product as a result of user test sessions.	α = .605 (n = 74)
6. UCD is worth the effort and cost.	8. In general, I would not recommend that other development teams spend effort on UCD activities.* 6. In my opinion, UCD activities are worth the effort. 7. The expenses incurred by UCD activities are offset by savings elsewhere in the development process or life-cycle of the product. 9. In my development work, I find that the extra time it takes for UCD activities does not frequently enhance my products.*	α = .574 (n = 77)
7. Usability specialists are helpful in improving product.	19. Most usability specialists are primarily interested in improving the overall quality of my program. 4, Usability specialists do not do much except point out the "mistakes" of my programs.*	α = .641 (n = 57)

*These items negatively loaded on a factor, and were reverse-coded when computing scale scores for each factor.

(2) General Attitude

Results of a descriptive analysis of the Likert-scale attitude questions suggest that the respondents had moderately positive attitude towards UCD activities (1=strongly disagree, 2=disagree, 3=undecided, 4=agree, 5=strongly agree). As seen in Table 4, the respondents tend to strongly agree that UCD is worth the effort and cost (M= 4.38, SD= .48). They also tend to strongly agree that it is important to conduct many user test sessions and that they learned a lot about their products from user test sessions (M= 4.11, SD= .68). Likewise, respondents tend to disagree that they learned little from user test sessions and UCD (M= 1.77, SD= .66). The overall mean was 3.79, which suggests moderately positive attitude towards usability.

Table 4. Descriptive Statistics for the UCD Attitude Factors

Factor	N	Minimum	Maximum	Mean	SD
1. User-centered design (UCD) is more work and costs more.	74	1.25	5.00	3.15	.94
2. User test sessions are valuable.	74	2.00	5.00	3.90	.61
3.Epiphany: experience of UCD changed my mind.	59	2.00	5.00	3.51	.69
4. Learned little from user tests and UCD.	67	1.00	4.50	1.77	.66
5. Many tests important, learned a lot about my product.	74	2.00	5.00	4.11	.68
6. UCD is worth the effort and cost.	77	3.00	5.00	4.38	.48

7. Usability specialists are helpful in improving product.	57	2.00	5.00	3.95	.78
Overall attitude	45	3.05	4.91	3.79	.37

(3) UCD Practices and Attitudes

Point-biserial correlations were done between the user-active UCD methods (presented in Table 2 with the + codes) and the 7 components of user attitudes toward UCD (presented in Tables 3 and 4). None of these correlations was significant at the 0.05 level. A new variable, "good UCD practices," was then constructed by totaling the number of items checked from the following practices: 1) testing out major design issues with users, 2) doing field studies/visits of users' work environment, 3) using paper prototypes, 4) using computer prototypes, 5) using think-aloud protocols, and 6) recording users' actions with a program. A significant positive correlation was found between the number of "good UCD practices" and the software developer attitude that "UCD is worth the effort and cost" ($r = .235$, $p < .05$). However, none of the other six UCD attitudes was significantly correlated with the number of "good UCD practices," nor was the overall attitude towards UCD correlated with the number of "good UCD practices."

(4) Developers' Background and their Attitudes

1. Position and Company Size

An analysis of variance (ANOVA) was conducted to see if there were any differences in UCD attitudes according to software developer position. Results showed that instructional software developers more strongly agreed that "user test sessions are valuable" than commercial applications software developers ($F = 6.874$, $p < .002$). Furthermore, instructional software developers tended to more strongly *disagree* that they learned little from user test sessions and UCD than did entertainment software developers ($F = 3.618$, $p < .033$). However, no significant difference was found among the software developer positions and their overall attitude towards usability ($F = 2.471$, $p = .098$). Also, there was no difference in attitudes towards UCD according to size of company ($F = 1.164$, $p = .341$).

2. Formal Training in Usability

Results of an ANOVA showed that there was no significant difference in the respondents' attitudes towards usability between the group who have had any formal training in usability and those who have not received any formal training in usability ($F = .213$, $p = .647$).

3. Experiences in User Test Sessions

Results of an ANOVA revealed that those who have attended user test sessions tend to more strongly agree that "user test sessions are valuable" ($F = 3.934$, $p= .051$), and that "it is important to conduct many user test sessions and they have learned a lot about their products from the user test sessions" ($F = 3.337$, $p = .072$). However, those who have attended user test sessions also tend to more strongly agree that UCD is "more work and costs more" than conventional development activities ($F = 4.634$, $p = .035$). In addition, those who have experience in helping conduct the user test session also tend to more strongly agree that "UCD is worth the effort and cost" ($F = 5.555$, $p = .021$) than those who have no such experience.

4. Access to Usability Specialists and the Developer's "Good UCD Practices

An ANOVA was conducted between the group who had a usability specialist either in their team or as a consultant and those who had no access to a usability specialist in order to compare the number of "good UCD practices" between those two groups. The results showed that significantly more good UCD practices were reported by software developers who worked on teams that either hired usability consultants or had a usability specialist on their teams compared with those who had no usability specialists at all ($F = 10.047$, $p = .002$). The means for each group was 3.9 for the group who had access to usability specialists, and 2.7 for the group who had no such access, respectively.

Discussion

Results suggested that while the respondents considered the UCD process more work and additional cost, they viewed UCD as a positive, worthwhile practice. The software developers who attended user test sessions and helped conduct sessions reported more positive attitudes than others. This would suggest that active participation in usability tests may be a factor in developers' positive outlook concerning usability tests.

We were intrigued, however, with the apparent lack of findings in many of the areas for which we performed analyses. For example, we had expected attitude differences between those who have had formal training in UCD and those who have not. No difference in attitude was found.

Most intriguing, however, was the software developers' apparent lack of use "good UCD practices." That is, while the respondents reported UCD as a positive and beneficial practice, this was not correlated with reported numbers of good UCD practices.

Perhaps most important is having a usability specialist either as a consultant or as a team member, since this is associated with greater numbers of good UCD practices. Given that only 30 percent of software developers have received any formal training in usability -- and when they did, it was most likely from books and journals -- it appears worthwhile to have usability specialists on the development team.

Finally, this study is limited by the generalizability of its findings. We do not know if those who responded to the survey are representative of software developers in general. Also, our data were collected in 1994-96, and it is possible that software developers' attitudes and their company's UCD practices may have changed since then. However, our results seem to be consistent, in part, with a recent survey of HCI professionals in North American industry in which respondents were asked to identify what organizational approaches and usability methodologies they perceived to be most effective in having a strategic impact on corporate decision-making (Rosenbaum, Rohn, & Humburg, 2000). The size and type of company along with the size of the usability group within it were all considered, but no statistically significant relationships proved to exist between the demographic data and the organizational approaches and usability methods employed. In our study, we found no relationship between software developers' attitudes toward user-centered design and good UCD practices.

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Transforming a Lecture-Based Course to an Internet-Based Course: A Case Study

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Abstract

The rapid increase in the use of computer technology to facilitate alternative forms of educational delivery, often called distance education (DE), represents a major change taking place in education. The potential for decoupling the traditional requirements that student and teacher be present in the same room at the same time has never been greater.

Many teachers will soon decide to design, or be asked to design, courses for distance education in virtual environments for the first time, but they will not have many published principles to guide them. This research project, which represents portions of my doctoral dissertation, describes an instrumental qualitative case study examining the process that an educator must resolve when designing a distance education course from a preexisting traditional course. My research focused on the transformation of a widely-taken, lecture-based course to a largely asynchronous, web-based course.

During this study, the principal guiding question was: What aspects of content, design, and andragogy would an instructor consider when transforming a lecture-based course to one incorporating web-based instruction? In addition to this overarching question, a number of related questions regarding the selection of team experts and devising suitable methods for regulating student—student and teacher—student interactions were considered.

A number of key themes and issues manifested themselves during the course transformation process, primarily those concerned with unexpected problems and technical difficulties, and those focused on the pedagogical novelty involved with distance education.

The course displayed far fewer technical problems than anyone might have imagined. However, issues regarding teacher evaluation and the possible consequences for tenure evaluation were totally unexpected by the principals involved. The issues surrounding the newness of distance education, for both student and instructor, demonstrated enormous complexity. Pedagogical matters on how time and space affected the course, on what "interacting" means in a distance education environment, and the new varieties of limitations and constraints imposed by distance education must be considered by future distance education instructors.

Background

As we approach the new millennium, all objective signs point to the fact that education, as well as a number of other social institutions, appear to be undergoing radical transformation. These changes may involve all levels of the educational system from pre-kindergarten through higher education. Many believe that these upcoming changes will inaugurate the greatest systematic modifications since the Middle Ages, when universities shifted fundamentally from locations that congregated assemblies of great scholars and thinkers to those seeking to become great repositories of the latest technological education innovation: the printing press and books (Nyiri, 1997).

One major change taking place in education is the rapid introduction of computer-assisted educational delivery, often called distance education (DE). Other terms for distance education, such as "open learning," "distributed learning," "web-based instruction," and "flexible learning," have also been used, and these terms often compete and substitute for one another indiscriminately. Many of these terms show subtle distinctions that can best be discerned by considering the environment and the frame of reference used by the institution offering the instruction.

Regardless of the particular variety, distance education platforms all share a number of characteristics in common (Peters, 1993): (a) teachers and students are apart; (b) the learning often takes place in the home of the student; (c) the teaching-learning process often takes the form, or uses components of, independent study; (d) students do not have to cease working or interrupt their schedule while taking the course.

Our contemporary variations of distance education incorporate the newest technologies of computer networks and modern telecommunications. With the advent of these new advancements, the potential for decoupling the traditional requirements that student and teacher be present in the same room at the same time has never been greater. From an operational point of view, distance education can be thought of as a set of variations in the educational processes and technologies that take place without these conventional requirements.

Today three different types of technologies tend to dominate in distance education: videoconferencing, interactive broadcasting, and online formats. Videoconferencing and broadcasting generally require that the participants meet at the same time although the location of the participants may vary considerably—from different sites on the same campus to different cities, states, or even countries. This variety is called synchronous distance education (SDE). In the latter technology, called asynchronous distance education (ADE), the participants are constrained by neither time nor location. The increasing trend among distance educators involves integrating multiple platforms to maximize the benefits of each method of delivery. This study followed a team as they developed a largely ADE course for Internet delivery.

While distance education has existed in its many forms for more than a century, it has never played a major role until recently (Barley, 1999; Martin, 1999). This may soon change since the ability to reach students previously cut off from the traditional face-to-face, lecture style of education has excited many educators and politicians alike.

The United States Department of Education recently began tracking the availability of distance education courses in higher education (Lewis, Alexander, & Farris, 1998; Lewis, Snow, Farris, Levin, & Greene, 2000). They reported that for the 1995 fall term approximately 58% of 2-year public higher education facilities and 62% of 4-year institutions offered distance education classes. Overall about 33% of institutions offered distance education courses. Their next survey covered data for post secondary education institutions for the 1997-1998 school year (Lewis, et al, 2000). Among public 2-year institutions, now 62% offered distance education courses, while public 4-year institutions offering distance education courses rose to 78%. As in the previous survey, private institutions lagged behind public institutions, with only 5% of 2-year private schools and 19% of 4-year programs offering distance education courses. The trend for increasing use of distance education in the near term is clearly escalating.

Private institutions have reacted differently from public ones. In 2-year private institutions only 2% offered distance education courses, and only 12% of 4-year institutions offered distance education courses. Many of these elite campuses have taken a more selective approach and focused on specialized degree programs and curricula that can be exported to international audiences without interfering their local, on-campus strategies (Blumenstyk, 1997). As the United States currently undergoes its massive build-up in the race to embrace distance education technologies within its educational systems, questions regarding the effectiveness and best practices of distance education remain unanswered and often even unasked.

While many different forms of distance education varieties are being tried across the country, using the Internet as a delivery vehicle has become increasingly popular. In the United States, college courses have increased their use of e-mail from 8% in 1994 to 44% in 1998, and the use of other Internet resources and World Wide Web (WWW) pages for class materials also show dramatic increases (Institute for Higher Education, 1999). In 1998, the United States Department of Education found that 1,680 institutions offered 54,000 distance education courses, with 1.6 million students enrolled (Carnevale, 2000). This growth is all the more amazing when considering that, except for a small number of experimental courses, the number of such courses offered in 1995 approached zero. A probable reason for this may have been the fact that browsers and other software tools only existed in primitive forms until recently.

The true number of distance education courses offered is presently unknown, however. Criteria have yet to be established on what should be considered a distance education course. For example, in some colleges, courses simply having a syllabus available on-line would qualify as a distance education course. In the very near future, some method of assigning an approximate percentage of the course that takes place via distance education will have to be devised.

Many teachers will be designing courses for distance education environments for the first time, and they will be doing so for a variety of reasons. Some will offer their courses in this manner because it appeals to them out of curiosity or because they are personally interested in the technological innovations and want to experience them first hand. Others believe the new technologies may improve or enhance their current courses by offering students new ways of looking at, or contemplating, a problem, or a new way of thinking. Many will be offering their courses for less than optimal reasons. Administrators, desiring to reach as many students as possible, might pressure them to take their courses online. To accomplish this, they may want to add some form of distance education to supplement their traditional student base. Some administrators will want their institutions to be seen as leaders of the field or simply may not want to be seen as laggards, out-done by their competitors (Martin, 1999). Whether these teachers will be transforming their existing, traditional courses or designing new courses de integro, they often will be uncertain as how to proceed.

To many of the "early adopter" educators, those first to undertake distance education in their classes, their efforts often focus on transferring as much as possible from what they have already prepared for their traditional classes without consciously adapting their materials to these new media. While this may be an obvious first approach, it cannot be as effective as when instructors completely rethink and reevaluate the advantages and disadvantages of the new medium. The most effective distance education educators will focus on which specific distance education options are the most appropriate for their given curricula.

As part of my case study, I met and interviewed Dr. Gwendolyn and other principals throughout the course development process. I observed how she approached the transformation process and how she evaluated which changes needed to take place in the newly transformed course. I observed how and why decisions were made regarding course content, student-faculty interactions, and student-student interactions. I also followed how she interacted with the instructional technologists who helped her give shape to the on-line course in the form of text, audio, graphics, animation, and video media. I was given access to all content meetings and was allowed to observe the group decision-making process and how they delegated tasks and made assignments.

Research Overview

A department within the business school of a large southern, urban university began their experimentation of offering web-based instruction by granting Dr. Wolf release time to develop an online course. The department heads selected a graduate gateway course for the experiment, i.e., an introductory class required of all incoming graduate students within that department. The course also acts as a pre-requisite for many other graduate courses within the entire business school.

Cast of Characters

The primary members in this research effort included: Dr. Wolf, Dr. Gwendolyn, Dr. Summerville, Mr. Masterson, and Ms. Veritago. Each person brought unique skills to the process as tabulated below. Dr. Wolf assumed the chief responsibility for the course content and would teach the class when completed. Dr. Gwendolyn acted as team coordinator for both phases of the project as well as the instructional designer for the course. Dr. Summerville contributed greatly as a subject matter expert. Dr. Wolf, Dr. Gwendolyn, and Dr. Summerville acted as the principal content team during the development phase of the project. Mr. Masterson and Ms. Veritago joined Drs. Gwendolyn and Wolf in the second phase of the project and contributed largely as web-page designers and to web site maintenance.

The Transformation Process

In the first phase of the process, the team examined the course material for two primary considerations: the relevance of the subject matter for the current demands of the field and the suitability of the course material for use in a web-delivered environment. Drs. Wolf, Gwendolyn, and Summerville presided over this "transformation phase" of the project.

Administration

According to Dr. Wolf, his department cited several reasons for wanting to experiment with distance education within their programs. While the business college boasts an excellent reputation and usually attracts more student applications than available open slots, some problems were beginning to emerge. The reasons for undertaking the course transformation are summarized in the table below.

Table 1 Summary of Dr. Wolf's Department's Reasons for Developing DE Courses

Stakeholders	Reasons for participating in DE Courses
Students	None directly solicited
Faculty	Increasing travel demands Potential for improving courses
Administration	Perceived demand by students Increase the number of students per class Perceived competition by other college programs offering DE courses Reduce time and space constraints for students attending college courses Reduce traffic and parking congestion on campus

Students

In preparation for overseeing the transformation of the course, Dr. Gwendolyn formulated a 12-step program for implementing the transformation of the course from a lecture-based format to an Internet-based format. She relied heavily on her TWIGS (tools for web-based instruction: generating structures) concepts, generated from her previous research and experience designing distance courses, to guide Drs. Wolf and Summerville in reviewing the course materials for suitability in the new educational medium.

The TWIGS document guided the instructors to design their distance education course to the needs and requirements of the students by posing a series of questions in a number of different areas. One of the difficulties with the course in question related to the very different technological skills that students bring to the course: some are technological neophytes and others are technological experts. In general the students were pursuing their MBAs, in their twenties, worked full-time, and had several years of "real world" business experience. Some of the students would be of foreign birth and not speak English as their native language.

Instructors

For approximately five months, Drs. Wolf and Gwendolyn accepted the challenge of designing a web-based course based on a course that had been traditionally taught in a face-to-face manner. Drs. Wolf and Summerville, acting in their roles of subject matter experts, carefully reviewed every topic in past course syllabi to determine if the material continued to be necessary and vital for students in the field to understand and master. They worked with Dr. Summerville to review the content of the course and make certain each element of the syllabus remained important and relevant given the rapid changes that are taking place in real-world business environments. Under Dr. Gwendolyn's guidance, the team reviewed the course syllabus; considered under what parameters the students would access the Internet and how that might affect their course design; discussed the number and types of tests that would be used; and reviewed which communication features—synchronous, asynchronous, or both—the course would incorporate.

The principals agreed to incorporate both synchronous and asynchronous components of distance education. Dr. Gwendolyn pointed out that too much time devoted to SDE would take away many of the advantages of distance education, in general, by tethering the students to their computers at certain times. This was especially relevant to the given student population since so many of them worked full time.

In the process the course material underwent drastic changes. During this process, they did not take into account the suitability of the material for distance education delivery, and it fell upon Dr. Gwendolyn to accommodate as much of the content and style of presentation as possible and to let them know if she believed changes needed to be made to suit the medium.

Design Process

During the last stage of the course development, what I call the Design Process, the content of the course had already been determined, and the team now focused on how what type of course management software would be used and the graphic design and style of the web pages. Dr. Gwendolyn proposed three possible options for web course management software: use a pre-existing, off-the-shelf product such as WebCT or Blackboard.com, design a proprietary, custom-made software, or a hybrid solution of modifying the commercially available software to best suit Dr. Wolf's needs. Each option offered strengths and weaknesses. The commercial software would be the easiest to use, but it would also be the most rigid, forcing any instructor to utilize preformed templates. The proprietary software would allow instructors nearly unlimited freedom in how their course materials would be presented and how students would interact with the material, but it would be the most difficult to design, would be difficult to maintain, and would not allow other faculty members within the department an easy template to copy for their courses. Dr. Wolf decided to employ the hybrid solution as providing some flexibility but still allowing those within the department some guiding design prospects.

Dr. Gwendolyn had three main goals for her design principles for the course: (a) accommodate the instructor's style of teaching as much as possible; (b) provide a relatively easy to use model for other instructor in Dr. Wolf's department to emulate should they decide to transform classes of their own; (c) adhere to standard graphic design principles to maximize ease of reading of text and viewing of graphics.

Mr. Masterson and Ms. Veritago reviewed Dr. Wolf's class notes and PowerPoint slides and redesigned them for consistency of appearance and legibility. These style guides would apply to all documents on the web site. Dr. Wolf was pleased with the results.

The design team incorporated several features within the web page that Dr. Wolf found useful for this course and for possible improvements for future courses. They used time-sensitive coding so that answers to assignments and exercises only appeared after a given date. "Page tracking" offered the possibility of tracking which web pages were utilized by students the most. This feature offered an indirect measure of which parts of the web site the students found the most useful.

Attempts to have outside evaluators review the web site did not produce as much information as hoped for. Dr. Summerville's face-to-face class looked at the course prototype but only provided a small number of comments. Other instructors in other institutions had agreed to review the website but because of time conflicts only provided very basic comments.

Discussion

As long as I've got an IP connection, I've got a classroom.
—Dr. Summerville

This stuff will eat you alive—if you let it.
—Dr. Gwendolyn

A number of key themes and issues manifested themselves during the course migration process, and I have grouped them into two categories: those concerned with unexpected problems and technical difficulties, and those focused on the pedagogical novelty involved with distance education.

Technical Difficulties

The course displayed far fewer technical problems than either Dr. Gwendolyn or Dr. Wolf imagined—they both expected far worse and doubted other instructors would be so fortunate. The one major problem of students being kicked off the chat room site when another student entered continued throughout the term was never resolved. For the next term, Dr. Wolf ported the course into WebCT, and the problem never recurred.

Instructor Evaluations and Tenure

As with many other universities, Dr. Wolf's department uses student evaluation of instructors as part of their protocol for determining academic tenure. His particular department makes use of a series of questions that students rank on a 5-point scale, with one being the lowest score and five the highest score. Dr. Wolf was surprised by the relatively negative student evaluations he received at the end of the course. His scores averaged 0.5 points lower than his usual scores. While many of these comments might be attributed to the fact that he was teaching the course for the first time, it is equally possible that many of his low scores might be attributed to the fact that the students were given a traditional, face-to-face instructor evaluation form to fill out. The form contained a number of inappropriate questions that might have confused the students or possibly caused them to give less careful consideration to the process than they might have under different circumstances. For example, Question 4 asks if the instructor "is accessible to students out of class," and Question 6 asks if the instructor "speaks in a manner that is easy to understand." While only a handful of the 37 questions appearing on the evaluation form might be considered totally irrelevant, more than one-third of the questions have either little relevance to courses taught at-a-distance or would have to be modified or clarified in some manner to better accommodate the circumstances involved in the new environment.

Dr. Gwendolyn's department, at her university, requires that she use traditional evaluation forms for her online classes, but she augments that data by asking her students to fill out an evaluation form of her own design. This simple solution might have salvaged a better review for Dr. Wolf and made the entire experience more rewarding for him.

As a by-product of the instructor evaluation disappointment, Dr. Wolf raised the issue of tenure evaluation. As an assistant professor, Dr. Wolf felt he must keenly focus on areas related to tenure. The department establishes requirements for tenure, some of which are explicitly recorded and some that are more nebulous and subjective. Since teaching distance education courses generally requires more effort than traditional courses, yet does not generate extra rewards for that effort, Dr. Wolf decided he no longer wanted to teach them at this stage in his career. He felt the potential for lower evaluations could not justify the extra effort involved. Dr. Wolf thought the department should offer bonuses, in the form of release time or other similar benefits, to instructors offering to teach online.

Intellectual Property Rights

While the debate over who owns the rights to distance education courses rages on in a number of universities (Noble, 1998a), only one of the principals, Dr. Summerville, voiced any concern over the controversy. Neither Dr. Wolf nor Dr. Gwendolyn expressed the slightest concern over the matter, but I believe the subject should be discussed and given careful consideration. At the present time, the issue may not be that important since most of the instructors involved in distance education pursue distance education for their own interests and curiosities. However, as the push towards distance education continues, and universities become more insistent that their instructors offer distance education courses, the matter might not be so benign.

Thus, while the issues of intellectual property rights and ownership have not played a role in the current course transformation, I believe it is an issue of extreme importance. Future distance education instructors may wish to investigate this matter when the time comes for their initiation into teaching at-a-distance.

Redefining Time and Space Within a Distance Education Environment

As stated earlier, distance education can be thought of as a set of educational policies and technologies that allow both the student and instructor to be separated in time, space, or both time and space. The process of transforming this graduate course involved a number of stages, and many of them related to issues of time and space, either directly or indirectly. While many might think the boundary between time and space as quite distinct, the two dimensions can actually be considered intertwined. For example, when a student complains of the requirement of traveling to a local college campus to attend a class, seemingly a "space" demand, part of the complaint actually embeds the <u>time</u> required for the journey: the actual travel time, time spent searching for parking, and time spent walking to the classroom building. Thus, just as these two dimensions are mutually linked in the concept of a space-time continuum in high-level physics, these two attributes appear to be conjoined in the everyday world as well.

While the official reasons for wanting to transform courses were largely administrative and financial, students and instructors generally hold other motivations for being involved with distance education, particularly those associated with convenience in space-time. As mentioned above, older students, or those married with families, often need flexibility while scheduling classes. In fact, without the option of controlling their course scheduling requirements, they may not be able to take part in degree programs. But the issues of space-time relating to distance education go beyond simply whether a student can attend a class at a given time. In addition to simply "showing up," students have always had to complete homework, exercises, and class projects; participate in class discussions; and communicate with the instructor and with other students. Most (if not all) of these items will still have to be successfully navigated in a distance education environment and will be complicated by the constraints of the new medium.

Instructors may have an even more demanding reliance and dependence on space-time issues than do the students. As reported earlier, instructors in Drs. Wolf and Summerville's department must travel frequently, often disrupting their teaching schedules. When Dr. Summerville heard about the amount of time Dr. Gwendolyn spent in reading student communications, he considered the continuous servicing of the online site a form of "electronic tether." This seemed quite ironic since one of his main reasons for exploring distance education courses was the opportunity of breaking the tether of the physical space of the classroom. ("As long as I've got an IP connection, I've got a classroom.") Would distance education simply substitute the time tether for the space tether rather than eliminating the tether concept altogether?

The issues surrounding the novelty of distance education, for both student and instructor, demonstrated enormous complexity. Pedagogical matters on how time and space affected the course, on what "interacting" means in a distance education environment, and the new varieties of limitations and constraints imposed by distance education must be considered by future distance education instructors.

Preparing Students for Distance Education

While this research project specifically focused on what types of preparations an instructor might need to take into account in transforming a class, the needs of the student must also be taken into account for any distance education course to be considered successful. Dr. Gwendolyn often referred to the idea that first-time distance education students were "learning how to be different types of learners." Dr. Wolf also commented on how he had lost sight of the students' sense of being novices with taking distance education courses during part of his preparations and implementations for some classes.

While the idea of preparing some type of primer or manual for novice distance education students surfaced on a number of occasions, Dr. Wolf's team did not prepare or distribute such a manual for the students before the course began. The purpose of such a document would be to alert the students to some of the differences in taking a distance education course versus traditional course, This oversight did not emerge as an issue during the "postmortem" interviews after the course ended, and it only occurred to me during the write-up phase of the research that there were plans for such a document.

Departments, colleges, or universities desiring to expand their traditional base of students and enter into the world of distance education might consider publishing and making such documents readily available, even before the class begins. As one example, Pennsylvania State University's online program offers online tutorials and suggestions for students to determine if they might be could candidates for distance education courses as well as ways to prepare for online instruction. Students would perform better if explicitly told of the different nature of the demands placed on them in these new environments, and it would help any instructors considering such course transformations, as well.

The new and different learning styles required of students taking distance education courses might be thought of, in some manner, as different ways of conceptualizing and managing time. Dr. Gwendolyn pointed out that people in our culture possess an almost innate understanding of what it means to "go to school" in the sense of knowing the requirements of physically going to the campus, attending class, taking notes, studying for and taking exams, etc. As with all novel ideas, concepts involved in taking a distance education course will have to become learned, and this must occur over time. Many of these concepts involve time, for example, remembering to turn on the computer at a certain time (for a synchronous session); remembering to regularly check the web site for any changes, corrections, or updates; remembering to regularly post to bulletin boards; etc.

Limitations and Constraints in Distance Education Environments

To many educators, distance education offers unparalleled freedom of choices, with untapped or previously unavailable populations of students taking their courses whenever their schedules allow. However, in preparing this particular course for teaching at-a-distance, the opposite situation, problems of constraints and limitations, often arose. The first set of constraints arose because the course was being taught in the summer-shortened semester. Instead of the more luxurious 16-week term, which might have allowed for a more gradual roll-out of the online course, Dr. Wolf was faced with an 8-week course that immediately required his students to double up on their weekly lectures and quickly adapt to the new learning medium. The shortened semester also presented difficulties in setting up the chat room sessions and forced Dr. Wolf to hold both sessions on the same day. While undertaking a course transformation would be considered trying under even benign circumstances, the difficulties in scheduling, planning, and preparing a course syllabus were magnified by the limited time available in a shortened semester. Simply doubling the course meeting time in a semester half the usual length can never guarantee results equal to that of a normal semester. For example, some courses with large reading requirements may not afford the students ample opportunity to reflect over what they have read. The extra weeks of a semester might be critical for true understanding of the materials presented.

Dr. Gwendolyn spoke of the time requirement needed for people to adjust to the new expectations and procedures in distance education courses, for both students and instructors. In this case, a full semester might have also given the students more time to adjust to the new learning methods and techniques required in distance education environments. If they had been more comfortable in their new environment, they might have been more generous in their course evaluations.

Even within the structure of a longer term, the freedom promised by distance education must not be regarded as a panacea for all circumstances. Dr. Gwendolyn recounted an interaction with a student who had been commenting that he took the distance education course because he thought it would be the best choice to accommodate to his heavy business travel schedule. Instead he ended up with a course that required a great deal of student input on a regular basis. He thought it was the most restrictive class he had ever taken rather than the most liberating. Perhaps if he had taken the same distance education course offered by another professor, he would have been able to travel on business and complete the course without as much difficulty.

As the number and availability of distance education courses increase in the future, the full range of offerings might one day rival those available with traditional classes. Perhaps the description of a particular distance education course might include the type of information that would have aided the student in the example above and that type of unexpected difficulty might be avoided.

Other constraints revolved around the discussion of technological access to the Internet. Drs. Wolf and Summerville wanted to include some types of video clip formats for their course, but using video required high-speed Internet access, which was not available to most students. They had to make certain that any features incorporated into their web pages could accommodate the lowest common denominator of access, which amounted to using a modem set at 30 kps (kilobytes per second). Using such a slow value of 30 kps as a general standard might surprise some readers, since the vast majority of people have access to 56 kps modems. A number of smaller calling areas, however, still limit access to 28.8 kps, and 30 kps was taken as an average. As forms of high-speed access become more readily available, this constraint will be lifted.

Relevance of Andragogy and Change Theory in Distance Education

Early in the research process, I proposed that Malcolm Knowles's (1977, 1980, 1984) theory of andragogy might provide the most reasonable theory to frame this case study research. Dr. Wolf, based on this distance education class experience and with those of past classes, confirmed the majority of Knowles's description of the adult learner. Knowles's last assumption concerns motivation for learning, and in this case, Dr. Wolf's students did not adhere strictly to an adragological framework. Knowles presumed that internal motivational forces of self-esteem, self-actualization, and recognition would provide greater incentives than the external motivators of job success and financial reward. This might reflect Knowles's work environment while he was developing his theories, in that he was in largely involved with what would be called today "continuing education." For the course involved in this research, while internal motivators played an active role, most of the students were driven by external, career factors.

While Knowles's theory of andragogy may not be the best available theory to study and investigate distance education, another possible candidate might exist: change theory. In his 1999 address at Northwestern State University of Louisiana, Fuller addressed the need for considering a new cultural transformation and reeducation of adherents for distance education to succeed (Fuller, 1999). Relying on two notable historians of science, Thomas Kuhn and Kurt Lewin, Fuller proposed ideas for effecting systemic change in educational institutions noted for gradualism and continuous change.

Fuller believed that the role of technology had less to do with the curriculum of a subject taught online than did the actual underlying culture that taught online. He did, however, acknowledge the new role technology played between "instructor and instruction," and realized the differences among all participants in the new era of distance education, including trust between instructors and administrators:

> The commitment to distance education, as a new paradigm of instruction, requires a commitment to understanding the rules of instruction differently within the new dispensation. It requires commitment on the part of the faculty and institution, and implies a willingness to reveal much—perhaps to risk much—on the part of the faculty members participating in the project. (p. 5)

Reigeluth and Garfinkle (1994) also addressed the issue of systemic change within educational systems. They stressed the needs for seeking out new ways of thinking in battling the problems facing education. They also voiced concern over the intricacy that incorporating systemic thinking involves:

> Systemic thinking is also difficult. It requires keeping many aspects of the problem set in your head at one time. It is a community activity, not an individual one, with all the requisite challenges of any group task. Like design, system thinking demands persistence, because to think systemically means to constantly reflect back to previous assumptions, and to be flexible enough to change thinking that has been agreed upon previously. (p. v)

Flexibility appears to be a common theme among all researchers. Fuller embraced Lewin's theory of reeducation in the sense that basic human behaviors must change, and these changes cannot be gradual, whether in learning or training settings. For Lewin, reeducation involves a three step pattern by which old behaviors "unfreeze," change occurs, and the new behaviors "refreeze." This can only occur in a safe environment.

Dr. Wolf's experiences allude to the required safe environment for novice distance education instructors. In some sense, he trusted the departmental administrators to make allowances for his first venture into teaching at-a-distance. While he did not specifically mention how the department responded to his lower student evaluations, his decision to opt out of teaching future distance education courses appear to indicate they did not immediately allay his fears about how those evaluations might affect his position within the department.

While the changes between student and instructor may be the most obvious, perhaps more important are the changes required between the instructors and the administration (or institution, as Fuller wrote). Fuller concludes his speech with the following challenge:

Distance education requires a thoroughgoing change in the classroom and the campus. In some ways, the computers are the least of the revolution. The fundamental relationship among professor, the learner, and the institutions of higher learning are all on the line today. New models of classroom instruction are everywhere. It's time to test new ways that scholars can prepare themselves—to prepare each other and their institutions—to thrive in the new world. (p. 11)

Concluding Remarks

This study presented the experiences of one group of instructors as they transformed a traditional, face-to-face course to an Internet-based, distance education course. I tried to present as detailed and "thick" a description of the process as possible so that others interested in the prospect of transforming their own courses might understand the process as completely as possible. In the process, I uncovered a number of themes and concepts that I believe transcend the issues of this single case study and would be relevant to all distance education instructors.

By its very nature, distance education distorts and amplifies differences in the concepts of time and space. Nearly all of the key themes and concepts examined during this research reflected relationships of how people either reacted to or planned to account for variations in these two dimensions when compared to traditional, lecture-based education. Attending class; communicating, both in class as well as outside of class; compensating for the loss of verbal and nonverbal cues and body language; and the general issues relating to constraints and limitations within the confines of distance education can be attributed to these key concepts.

At the outset of this undertaking, I originally thought that Knowles's theory of andragogy would be the most suitable theoretical framework to support this research. I now do not believe this original assessment to be accurate. I think an investigation of change theory as applied in educational environments might be a much better framework for understanding the different processes that concurrently take place at the time of transition from traditional modes of instruction to distance educational practices.

All educators should be aware of the changes taking place in distance education, if not for their immediate teaching efforts, then for the necessity of observing the changes affecting their communities. A case study, no matter how thorough, can never hope to capture the ultimate answer of any research question—it can only hope to accurately portray what occurred in this one instance. I hope that this research effort will motivate and inform other novice instructors interested in using distance education in their teaching efforts. Additional research into the discovery of the best methods for transforming and adapting to this new environment must be forthcoming among all stakeholders in higher education.

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Scaffolding Students' Problem-Solving Processes on an Ill-Structured Task Using Question Prompts and Peer Interactions

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Abstract

This study examines the use of question prompts and peer interactions as scaffolding strategies to help undergraduate students with their problem-solving processes on an ill-structured task. The mixed research method, combining both experimental and comparative multiple-case studies, were used to study the outcomes as well as the processes of students' problem-solving activities in terms of problem representation, developing solutions, constructing argumentation, and monitoring and evaluation. The result of the experimental study showed that the students working with peers and also receiving question prompts (PQ) significantly outperformed the other treatment groups, that is, individuals with question prompts (IQ), individuals without question prompts (IC), and peers without question prompts (PC). At the same time, though the students in the IQ group did less well than the PQ group in the process of problem representation, they significantly outperformed the PC and the IC groups in the processes of problem representation, justifications, and monitoring and evaluation. There were no significant differences between the PC and the IC groups in any of the four problem-solving processes. It appeared that question prompts were a superior scaffolding strategy over peer interactions in supporting students' ill-structured problem-solving processes. However, the comparative, multiple case studies revealed the complexity of the peer interaction context and the relationship between question prompts and peer interactions. While this study confirms previous findings on the effectiveness of question prompts in facilitating students' cognition and metacognition, it also indicates the benefits of peer interactions, which were contingent upon group members' active and productive engagement, that is, questioning, explaining, elaborating and providing feedback among peers. The study implies that, in order for students to gain full benefits from peer interactions, the peer interaction process itself need to be scaffolded, especially when students were novice problem solvers; and question prompts, through expert modeling, may serve to facilitate this process.

Problem Statement

Complex, real-world problem solving is an essential component of learning. Based on previous research (e. g., Bransford, Brown, & Cocking, 2000; Bransford & Stein, 1993; Jonassen, 1997), engaging students in complex, ill-structured problem-solving tasks not only helps them to apply knowledge in real-world situations, but also to facilitate knowledge transfer. However, previous research has also pointed to students' deficiencies in problem-solving skills, for instance, failing to apply knowledge learned in one context to another, especially when solving problems on ill-structured tasks (Gick and Holyoak, 1980; Gick, 1986). While students' difficulties in problem solving are partly attributed to misconceptions or shallow conceptions of domain knowledge (P. J. Feltovich, Spiro, Coulson, & J. Feltovich, 1996), they are, to a greater extent, due to a lack of metacognitive knowledge (Brown, 1987).

Therefore, it follows that supports should be provided to students during problem solving in cognition and metacognition through various scaffolding strategies, such as coaching through prompts (Scardamalia, Bereiter, & Steinbach, 1984; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989; Schoenfeld, 1985; King, 1992), modeling through reciprocal teaching or peer-regulated learning (e.g., Palincsar & Brown, 1984; Palincsar, Brown, & Martin, 1987), and guiding students to self-generate questions (King, 1991). These strategies were found to be effective in fostering comprehension, monitoring cognitive thinking, facilitating general problem solving (e.g., Palincsar & Brown, 1984; Scardamalia et al., 1989), and supporting reflective thinking (Lin, Hmelo, Kinzer, & Secules, 1999).

Purpose of the Study

The purpose of the study was to investigate the effects of question prompts and peer interactions in scaffolding undergraduate students' problem-solving processes on an ill-structured task. Although these two strategies had been studied in previous research, few studies had been conducted on their use to support students' ill-structured problem solving. Hence, this study was focused on the effects of question prompts and peer interactions in scaffolding students' problem-solving processes on an ill-structured task, especially in *problem representation*, *solution*, *justifications*, and *monitoring and evaluation*, which characterize the major processes of ill-structured problem solving according to previous research (e.g., Sinnott, 1989; Voss, 1988; Voss and Post, 1988). It is hoped that the findings of this research can be applied in computer-based and web-based instructional design, in the context of both distance education and classroom instruction.

This study specifically addressed the following questions:

Question 1. Does the use of question prompts have an effect on students' problem solving on an ill-structured task in problem representation, solution development, justification, and monitoring and evaluation of solutions?

Question 2. Does the use of peer interaction have an effect on students' problem solving on an ill-structured task in problem representation solution development, justification, and monitoring and evaluation of solutions?

Question 3. Does the use of question prompts combined with peer interaction have an effect on students' problem solving on an ill-structured task in problem representation, solution development, justification, and monitoring and evaluation of solutions?

Question 4. How does the use of question prompts influence students' cognition and metacognition in the process of developing solutions to ill-structured problems?

Question 5. How does the use of peer interactions influence students' cognition and metacognition in the process of developing solutions to ill-structured problems?

Operational Definitions

In this study, *question prompts* refer to a set of static questions, both content-specific and metacognitive types, which were generated by the content domain experts and were designed to facilitate cognition and metacognition and guide students through problem-solving processes. They were related to a problem-solving task which students were engaged in. For example, "What are the parts of the problem?" was intended to provide cues to students, activate their prior-knowledge, and lead them to represent the problem. When prompted to reflect on their solutions, students were asked "How do I justify this specific system design? If I develop a web-based solution, for example, can I explain why I took that approach?" The question prompts were delivered through the web, which students had access to while working in a computer laboratory.

Peer interactions are defined as verbal interactions of students working together in small groups of three or four to engage in a task of ill-structured problem solving. Students were expected to engage in a problem-solving task, actively interact with each other to negotiate meanings, to help each other construct meanings, and collaboratively develop solutions to a problem. Although they may have different abilities, skills and background experiences, they were not assigned specific roles.

Method

Participants

115 undergraduate students were recruited from three class sections of an introductory course in Information Sciences and Technology (IST) at a major university in the United States to participate in the experimental study, and 19 of them also participated in the comparative, multiple-case studies. The course was designed not only to introduce basic concepts and provide an overview of information sciences and technology, but also to incorporate collaborative learning and problem-solving experiences. It consisted of two lectures and one laboratory session each week. The 75-minute lecture session was held by a professor. The 115-minute laboratory session was conducted by a teaching assistant. The primary purpose of the lab was to provide hands-on experience in information sciences and technology and develop technology skills as well as problem-solving and collaboration skills. There were two teaching assistants attached to the three class sections, with the principal investigator being one of them. All the three class sections shared a common curriculum and a core textbook, and the three professors and the two teaching assistants were considered equivalent in terms of their expertise and teaching experience. Due to the relative large size of the class (about 50 students in each class section), the class web site was used as a supplementary delivery medium to foster classroom instruction and monitor laboratory activities. The students were often required to work in teams to complete a course project or laboratory tasks.

Design

A mixed study design, combining an experimental study with comparative, multiple-case studies, was applied. According to Greene, Caracelli, and Graham (1989), mixed study methods help a researcher to seek triangulation of the results from different data sources, examine overlapping and different facets of a phenomenon, discover paradoxes, contradictions, and fresh perspectives, and expand the scope and breadth of a study. The experimental study, designed to answer research questions 1-3, was conducted to measure the students' problem-solving *outcomes* on an ill-structured task in the four problem-solving processes: *problem representation*, *solutions*, *justifications*, and *monitoring and evaluation*, and in four different treatment conditions: individuals with question prompts (IQ), individuals without question prompts (IC), peers with question prompts (PQ), and peers without question prompts (PC). The comparative, multiple-case studies, through observation, interviews, and think-aloud protocols, were carried out to gain insights into students' problem-solving *processes*, especially their cognition and metacognition, as influenced by question prompts or peer interactions. The case studies were expected to seek explanations to research questions 4-5.

The Quasi-Experimental Study

As the experimental study was integrated into the curriculum and carried out in a natural classroom setting, the participants were assigned to different treatment groups as intact groups. From Questions 1-3 the following hypotheses were generated:

1. Students working individually and also receiving question prompts will demonstrate better problem-solving skills on an ill-structured task than their counterparts who did not receive the question prompts in (a) problem representation, (b) developing solutions, (c) making justifications and (d) monitoring and evaluating solutions.

2. Students working with peers, with or without question prompts, will demonstrate better problem-solving skills on an ill-structured task than students working individually, with or without question prompts, in (a) problem representation, (b) developing solutions, (c) making justifications, and (d) monitoring and evaluating solutions.
3. Students working with peers but also receiving question prompts will demonstrate better problem-solving skills on an ill-structured task than all the other treatment groups (PC, IQ, and IC) in (a) problem representation, (b) developing solutions, (c) making justifications, and (d) monitoring and evaluating solutions.

The participants of the four different conditions were given the same task to solve during a 115-minute laboratory session. The task presented an authentic scenario (Table 1) concerning the content domain of IST, which required students to develop a solution report to the problem presented.

Table 1. The ill-structured problem-solving task

Many customers complain that they have difficulty finding items in a large store. This problem especially affects college students, who often have very little time for shopping. Since students are major customers in this small college town, the manager of a local major store has hired you (or your team) as a consultant to propose IT-based solutions to the problem. Your task is to make suggestions about the features to be included in a new information system. As part of this, you are to develop a simple model illustrating your proposed system. Based on the findings of a survey, the proposed information system should be able to help customers find items quickly, to present an overall view of all the items on a shelf and an aisle, and to map out the shortest route for getting all the items a customer needs to purchase. There may be some other important factors you may need to consider.

The participants who were assigned to the Question-Prompt conditions (PQ and IQ) received question prompts at the same time as they received the problem-solving task. The question prompts consisted of 10 question prompts categorized into four types of prompts:

a) Problem Representation Prompts: *What is the problem?*
b) Problem Solution Prompts: *How do I solve the problem?*
c) Justification Prompts: *What are the reasons for…?*
d) Monitoring and Evaluation Prompts: *Am I on the right track?*

There are a number of questions in each category of question prompts, as illustrated in Table 2:

Table 2 The justification prompts

<u>*What are the reasons for my proposed solution?*</u> • *How would I justify this specific system design. For example, if I develop a web-based solution, can I explain why I took that approach?* • *Do I have evidence to support my solution (i.e., the specific IT system I have proposed)? What is the chain of my reasoning to support my solution?*

The problem-solving reports were evaluated based on a judgmental rubric system to measure the four problem-solving processes by the principal researcher and another two raters. The interrater consistency was reached to ensure the reliability of the evaluation. A multivariate analysis of variance (MANOVA) (Stevens, 1986) was employed to analyze the relationships between question prompts and the four problem-solving processes, and between peer interactions and the four problem-solving processes across the four different conditions. As the MANOVA result was statistically significant, the univariate (ANOVA) results were examined for each dependent variable. For the significant univariate results, post hoc comparisons were performed to identify where the differences resided.

The Comparative, Multiple-Case Studies

Eight cases were studied. Four individuals, with two from the IQ and two from the IC condition, were selected for think-aloud protocols, which were conducted when each of them was engaged in the problem-solving task. In addition, observations and interviews were conducted on four selected groups to gather data about their problem-solving processes, two groups from the PQ and two groups from the PC condition. The multiple cases were analyzed for the purpose of theoretical replication, which either (a) predicts similar results or (b) produces contrasting results but for predictable reasons (Yin, 1989).

Miles and Huberman's (1994) data analysis model, which involves three subprocesses--data reduction, data display and conclusion drawing and verification, was used to guide the qualitative data analysis. The data analysis primarily consisted of the following steps: reading and jotting marginal notes on the transcripts; identifying patterns and labeling concepts; organizing labeled concepts into a data display matrix, identifying themes and drawing conclusions. The focus of the analysis was on cross-case comparisons viewed from different dimensions: the four ill-structured problem-solving processes and the effects of question prompts and peer interactions on cognitive thinking and metacognitive skills.

Results

The Quantitative Results

The results of multivariate analysis of variance showed overall differences for the treatment effect and the four dependent variables of problem-solving processes. The MANOVA results were statistically significant ($F = 4.025$, $p < .001$). Further, the results of the univariate ANOVA tests indicated that there were significant statistical differences in all the four dependent variables, with an F ratio of 20.43, 8.27, 11.26 and 7.21 respectively ($p < .001$). Table 3 is a summary of post hoc Scheffe mean comparison. It shows several statistical mean differences among the four treatment conditions in the four dependent variables. Table 4 summarizes the descriptive statistics for the dependent variables by treatment groups. It displays means and standard deviations of different treatment groups by the four dependent variables. As each dependent variable has a different subtotal of scaled points, percentage was used to create a common basis for comparison of means among the four dependent variables.

Table 3 Summary of post hoc Scheffe comparison

Dependent Variable	Representing Problem	Developing Solutions	Making Justifications	Monitoring and Evaluation
Comparison Group	Mean Difference (%)	Mean Difference (%)	Mean Difference (%)	Mean Difference (%)
Peer Question (PQ) vs. Peer Control (PC)	**35.9*** (PQ > PC)	**20.3*** (PQ > PC)	**33.7*** (PQ > PC)	**35.6*** (PQ > PC)
Peer Question (PQ) vs. Individual Question (IQ)	**17.6*** (PQ > IQ)	11.8	7.7	1.5
Peer Question (PQ) vs. Individual Control (IC)	**39.8*** (PQ > IC)	**21.3*** (PQ > IC)	**27.3*** (PQ > IC)	**34.8*** (PQ > IC)
Peer Control (PC) vs. Individual Question (IQ)	**-18.3*** (PC < IQ)	-8.5	**-25.9*** (PC < IQ)	**-34.0*** (PC < IQ)
Peer Control (PC) vs. Individual Control (IC)	3.9	1.0	-6.3	-0.8
Individual Question (IQ) vs. Individual Control (IC)	**22.2*** (IQ > IC)	9.5	**19.6*** (IQ > IC)	**33.2*** (IQ > IC)

Note.

a) The mean difference shown in this table is the subtraction of the second condition (on the lower line) from the first condition for example, 35.9 (Mean Difference for Problem Representation) = PQ - PC.
b) Mean difference (%) is calculated using the values which appear in Table 4.
c) (%). The mean difference is converted into percentage in order to create a common basis for mean comparison, as the subtotals for the four dependent variables are different.
d) *. The mean difference is significant at the .05 level.

Table 4 Descriptive statistics for each dependent variable by treatment group

Dependent Variables	**Treatment Group** Peer Question (PQ) (N=13) Mean%	SD %	Peer Control (PC) (N=11) Mean %	SD %	Individual Question (IQ) (N=15) Mean %	SD %	Individual Control (IC) (N=16) Mean %	SD %
Representing Problem	62.3	17.4	26.4	15.7	44.7	15.5	22.5	11.3
Developing Solutions	88.5	11.9	68.2	17.1	76.7	10.4	67.2	11.1
Making Justifications	79.1	18.1	45.5	12.5	71.4	17.1	51.8	18.7
Monitoring and Evaluation	61.5	31.1	25.9	24.6	60.0	30.2	26.8	22.7

As it can be seen from Table 3 and Table 4, The statistical results generally confirm *Hypothesis 1*, showing that students working individually and also receiving question prompts (IQ) demonstrated higher problem-solving skills on an ill-structured task than the individuals who did not receive the question prompts (IC) in (a) problem representation, (c) making justifications, and (d) monitoring and evaluating solutions. However, the IQ group did not perform significantly better than IC group in (b) developing solutions.

The statistical results only partially support *Hypothesis 2*. Students working with peers and also receiving question prompts (PQ) outperformed those working individually and without question prompts (IC) in all the four problem-solving processes. They also outperformed those working individually and also receiving question prompts (IQ) in (a) problem representation. However, no significant differences were found in any of the four problem-solving processes between the PC and IC groups. On the contrary, students working individually but receiving question prompts did significantly better than students working with peers but without question prompts in three processes: (a) problem representation, (c) making justifications, and (d) monitoring and evaluating solutions.

In testing *Hypothesis 3*, students working with peers and also receiving question prompts (PQ) demonstrated better problem-solving skills than the students in the other conditions (PC, IQ, and IC) in (a) problem representation. In (b) developing solutions, (c) making justifications, and (d) monitoring and evaluating solutions, students in the PQ condition did significantly better than those in the PC and the IC condition, though not than those in the IQ group.

The Qualitative Findings

The effect of question prompts. The cross-case qualitative analysis revealed that the question prompts supported students' cognition and metacognition through directing attention to their problem-solving processes, articulating thoughts, and providing guidelines. First, question prompts served as a “reminder” to direct the students’ attention to some important information they might not have thought about. They helped students to represent the problem, make connections between different factors and constraints and link to the solutions. In addition, the question prompts also led the students to think about alternative solutions and the viability of their solutions. A group of students who failed to use the question prompts and thus failed to think about all the possibilities and alternative solutions indicated the important functions of question prompts. Second, it was observed that question prompts reminded the students to state their reasons and construct arguments for their proposed solutions. Third, students mentioned that the question prompts were useful to help them organize their thinking and break down the problem into small steps. Therefore, the question prompts may have served as expert modeling to support students' cognitive and metacognitive thinking by guiding problem representation, metacognition, and the justification process.

The effect of peer interactions. The comparative case studies indicated that the greatest advantages of peer interactions lie in building upon each other’s ideas, questioning and providing feedback, providing multiple perspectives, and benefiting from distributed knowledge. Those attributes influenced students' cognitive thinking and metacognitive knowledge. It was observed in all the cases that when peers worked together, they typically started the problem-solving processes by brainstorming ideas, which were presented in the form of questions or suggestions, such as “How about…?” and “What do you think…?”. Then, an initial idea got further developed. It was also observed that during peer interactions, students asked questions, offered suggestions, elaborated thinking and provided feedback. Thus, peer interactions created an opportunity to ask, clarify, explain, and elaborate. The great advantages of peer interactions, as the participants consistently pointed out in their interviews, were the multiple perspectives and different expertise different individuals brought to the problem-solving processes.

Discussion

Here is a summary of answers to research questions 1 – 5:

1. Question prompts had a significantly positive effect overall on students' problem-solving processes on an ill-structured task, specifically in (a) problem representation, (c) making justifications and (d) monitoring and evaluating solutions.
2. The use of peer interactions had a partially positive effect on students' problem solving processes on an ill-structured task in that, the students in the PQ condition significantly outperformed those in the IC condition in all the problem-solving processes and the IQ condition in problem representation; whereas the students in the PC condition did not perform significantly better than those in the IQ or the IC condition in any of the problem solving processes.
3. In comparison with the separate use of question prompts and of peer interactions, the combination of question prompts with peer interactions showed the greatest positive effect overall on students' problem-solving processes on an ill-structured task.
4. In the process of developing solutions to ill-structured problems, question prompts influenced students' cognition and metacognition by (a) directing attention, (b) articulating thoughts, and (c) providing guidelines for problem solving.
5. In the process of developing solutions to ill-structured problems, peer interactions influenced students' cognition and metacognition by (a) building upon each other's ideas, (b) questioning and providing feedback, (c) providing multiple perspectives and (d) distributing cognition.

The result of the experimental study showed that the students working with peers and question prompts (PQ) significantly outperformed the other treatment groups, especially the students without question prompts (either working individually or with peers), in all the four problem-solving processes. At the same time, the students working individually and with question prompts, though they did less well than the PQ group in problem representation, significantly outperformed the PC and IC groups in problem representation, justifications, and monitoring and evaluation. There were no significant differences between the PC and the IC groups in any of the four problem-solving processes. It appeared that question prompts were a superior scaffolding strategy over peer interactions in supporting students' problem solving on an ill-structured task. However, the comparative, multiple case studies revealed the complexity of the peer interaction context and the relationship between question prompts and peer interactions. While this study confirmed the findings of previous research on the effectiveness of question prompts in facilitating students' cognition and metacognition, it also showed the benefits of peer interactions, which were contingent upon group members' active and productive engagement in peer interactions, that is, questioning, explaining, elaborating and providing feedback among peers. The findings supported Webb's (1989) research on the learning conditions for group collaboration.

The study implies that, in order for students to gain full benefits from peer interactions, the peer interaction process itself need to be scaffolded, especially when students were novice learners in problem solving; and question prompts, through expert modeling, may serve to facilitate this process. Further research is suggested to examine the transfer effect of question prompts on students' self-generated questions if students are provided with similar question prompts over a period of time and if their improved skills in self-generated questions during problem solving will facilitate them to solve an ill-structured problem. More research efforts are also needed to examine group dynamics when investigating the role of peer interactions in scaffolding ill-structured problem solving. Group dynamics involve many aspects, including peer learning approaches, peer interaction patterns, students' perception and motivation about peer learning, any of which may have an impact on students' problem-solving performance.

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Using a Video Split-Screen Technique to Evaluate Streaming Instructional Videos

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Abstract

The Media Center at Eastern Illinois University developed and streamed on the Internet 26 short (1-5 minutes) instructional videos about WebCT that illustrated specific functions, including logging-in, changing a password, and using chat. This study observed trainees using and reacting to selections of these videos. It set out to assess attitudes toward the quality of online videos and to identify perceptions trainees had about the video's impact on their learning. A secondary aim of the study was to evaluate the potential of a video-split-screen technique for making observations of trainees during training.

Trainees responded positively to the video training and the mode of delivery. They also perceived their learning to have been positively impacted as a result of it. As an observation tool, the video-split-screen technique was useful and it yielded much data in multiple media formats.

Instructional video training as presented in this paper appears to be a viable WebCT resource. An extensive development effort was not needed to produce a worthwhile product that is easily modified and updated. These facts coupled with trainees' positive reactions suggest that this instructional modality can be an effective supplement to face-to-face training.

Introduction

In 1997, the Media Center at Eastern Illinois University embarked on a technology training initiative aimed at improving faculty members' ability to effectively and appropriately utilize and integrate computer technology into the teaching and learning process. To foster faculty members' willingness to invest in using technology, the initiative provided services in three key areas. First, technical support services addressed software and hardware problems. For instance, an instructor having difficulty with HTML coding or a specific software application could call the Center for assistance. Second, the Center developed courseware applications as well as materials to support classes, including Web sites and CD-ROM materials. Third, the Center offered a number of faculty development activities, such as hands-on training workshops, informational sessions/demonstrations, and computer-based tutorials. In this paper, the authors limit the discussion of the initiative to the area of faculty (technology) development.

Subsequent to the implementation of the initiative the University adopted WebCT as its Web-based course development platform. WebCT is a development tool that enables instructors to create and distribute on-line class materials, or entire online courses. The University administration charged the Media Center with formulating a WebCT training program, as part of it existing training initiative. The program was to introduce the software to faculty and teach them how to use it for instructional and learning purposes.

The Center's staff delivered WebCT training primarily through face-to-face workshops that were 2-3 hours in length. Throughout each academic semester, they offered over 40 workshops on the following topics:

- WebCT basics: An Introduction to WebCT
- Using WebCT Communication Tools
- Using WebCT Quiz Modules
- Using WebCT Student Management
- Using WebCT File Manager, Course Content, Calendar

Several open sessions were also offered in which the staff presented no formal instruction but assisted faculty with developing content in WebCT.

Streaming Training Content

While the WebCT trainers successfully offered numerous workshops at varying times throughout the semester to accommodate faculty schedules, they observed three shortcomings with the workshop approach. First, despite the availability of sessions, class scheduling conflicts prevented some faculty from attending. Second, faculty indicated that the timing of the workshops did not coincide with the time they allocated for development. For example, one individual commented that while he attended a workshop in October, he was unable to do any WebCT development until the end of the semester, at which time, he thought his familiarity with the program would wane. Third, in many ways, the workshops did not support individual work habits or needs. Trainers offered all sessions during normal work hours and training was general in nature so that it accommodated the greatest number of participants. As a result, an individual working outside normal business hours could not call on the expertise of a trainer and was therefore left to his/her own resources to solve a problem. Moreover, individuals with specific WebCT needs or questions were difficult to accommodate during workshops, and the trainers observed that many of these unique needs were unmet.

The aforementioned issues associated with the workshop format prompted the Media Center staff to explore alternative training delivery modalities, one of which being streaming video training. Two staff instructional technologists developed 26 short (1-5 minutes) instructional videos about WebCT that illustrated specific functions, including logging-in, changing a password, and using chat. While the videos were general to WebCT, they contained information specific to Eastern Illinois University, such as how to access a WebCT course from the university home page or how to obtain a WebCT account. The technologists used a screen capturing utility (SnagIt) to record the WebCT screens, and they narrated while performing program functions (see Figure 1).

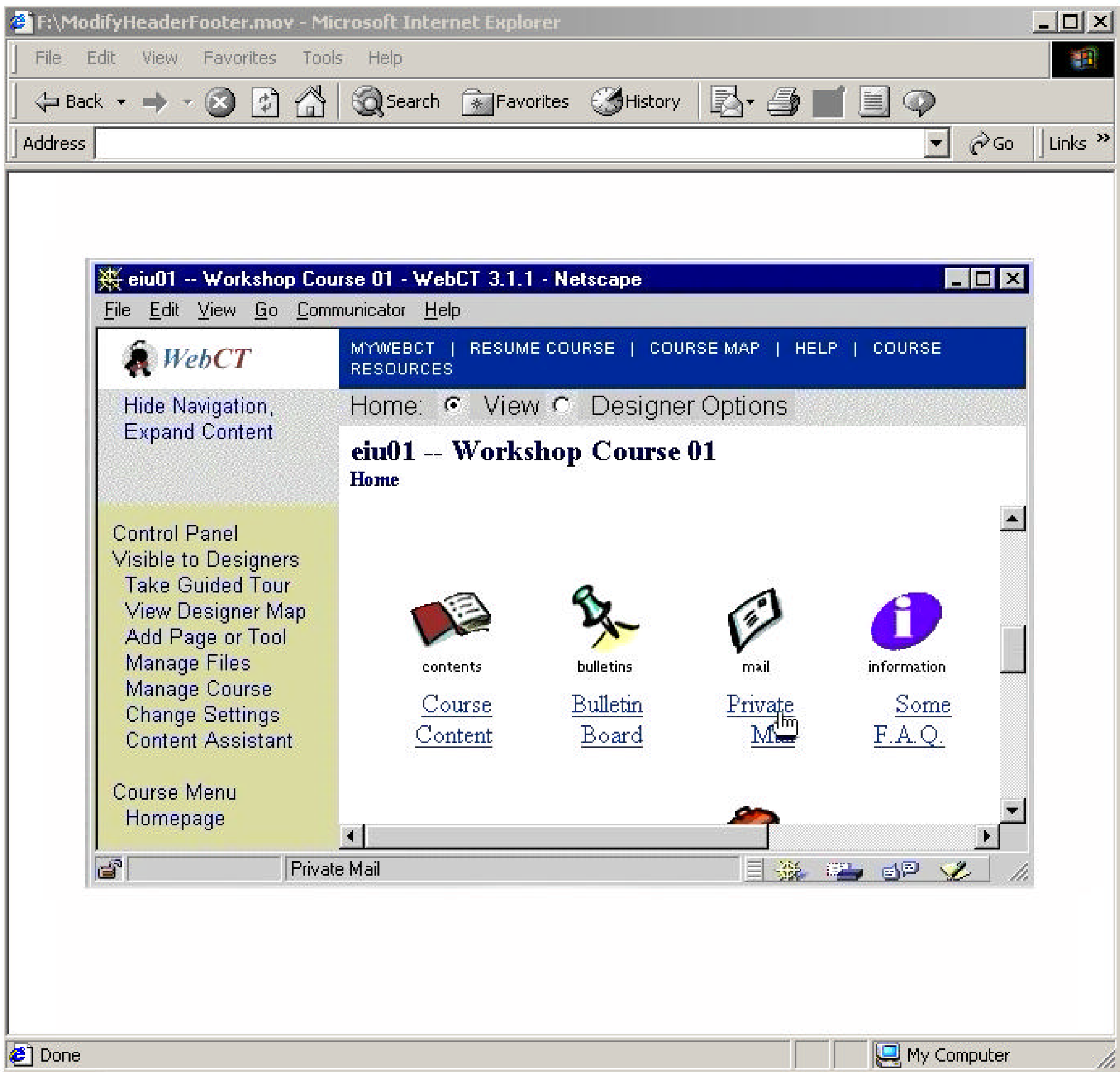

Figure 1. WebCT Video Played in a Web Browser

The approach did not require many hours of development, an important criterion of the technologists. Time constraints prohibited these individuals from spending exceedingly long periods of time developing the videos. Moreover, the changing nature of the WebCT software with updated versions, etc. necessitated a short development cycle.

Developing the WebCT Training Videos

As mentioned, the instructional technologists used the SnagIt software utility to capture computer video screens and audio narration simultaneously. The program records the video and audio into a single Avi file, which is commonly used in Windows-based PC's.

The recordings produced large file sizes that could not be streamed on the Internet and so the Avi files were converted to a QuickTime format. QuickTime was chosen because the Media Center owned a QuickTime streaming server. The accepted industry standard for converting audio and video files with the least possible quality loss (or generation loss) is Terran Corporation's Media Cleaner Pro. Version 5 of the software is called Cleaner. Cleaner and QuickTime Pro both encode miscellaneous QuickTime and streaming QuickTime files with constant bit-rate encoding using several different types of compression schemes.

Compressing video causes the video to shrink in size. Instead of encoding each frame of video with the entire contents of that frame, only the changes from frame to frame are encoded. In addition, if colors in an area of the video are similar, a single byte of information representing the entire area is used resulting in smaller file size. Smaller video files and lower data rates enable the video to be streamed more easily over the Internet and to be viewed on dated computers.

The Media Center also purchased a plug-in for Media Cleaner Pro called Sorenson Developer edition. In order to encode a QuickTime movie with variable bit-rate encoding the plug-in is required. Variable bit-rate encoding allows the bit-rate to vary as the file requires bytes resulting in higher quality video at a low average bit-rate. Constant bit-rate provides predictable data rates, but produces video of poorer quality.

Typically, the largest video frame size that can be streamed over the Internet or a very fast connection (e.g., T-1 or faster) is 320 X 240 with 10 frames per-second. Since the size of the WebCT videos was approximately 640 X 400, a compromise was achieved by decreasing the frame rate. To obtain the same data rate, one can increase frame size while decreasing frame rate or vice versa. Since the motion on the screen was mainly mouse movement and Web page scrolling, the file frame rate was decreased to 4 frames per-second.

After the files were processed by Cleaner 5, they were copied to the QuickTime server. The developers used a program called Make Reference Movie to create small QuickTime files (approximately 4K) that were placed on the university's web server along with HTML documents that linked to the videos.

Purpose

In the researchers' view, delivering the videos in a Web-based hypermedia environment was unique, and it presented a number of issues that needed careful examination. As a result, they set out to examine how trainees would use and react to the instructional videos. Specifically, the researchers set out to:

1. assess trainees' attitudes about the quality of the online instructional videos used in the project and the method by which they were delivered;
2. identify trainees' perceptions about the effectiveness of the videos to fostering their learning.

A secondary aim of the study was to evaluate the potential of a video split-screen technique for observing the processes (e.g., performance tasks/work behaviors) trainees engage in while using the instructional videos.

Method

Hypermedia, characterized by an arrangement of nodes and links, provides non-sequential access to mediated content (Kumar, Helgeson & White, 1994). These informationally rich and flexible user-centered designs add complexity to the study of how users interact with a system (Gay & Mazur, 1993). Some evaluation approaches promote a holistic orientation (Winograd & Flores, 1986) using qualitative methods (Card, Moran & Newell, 1983) and multiple data collection instruments (Marchionini, 1990). Instruments for monitoring human-computer interactions often allow for the compilation of data in visual (video, photographic), textual, and auditory form.

In accordance with a more qualitative approach to evaluation, the researchers used a video-split-screen recording technique to monitor how trainees used the instructional videos. A video camera recorded trainees as they used the software. Simultaneously, a scan converter converted the computer screen output to a video/NTSC signal. Both signals (trainee and computer screen) were sent to a video effects generator and combined into one image, which allowed the researchers to observe the computer screen, including mouse movements, object (e.g., buttons, links, etc.) selections, and web page changes simultaneously with trainees' behavior (see Figure 2).

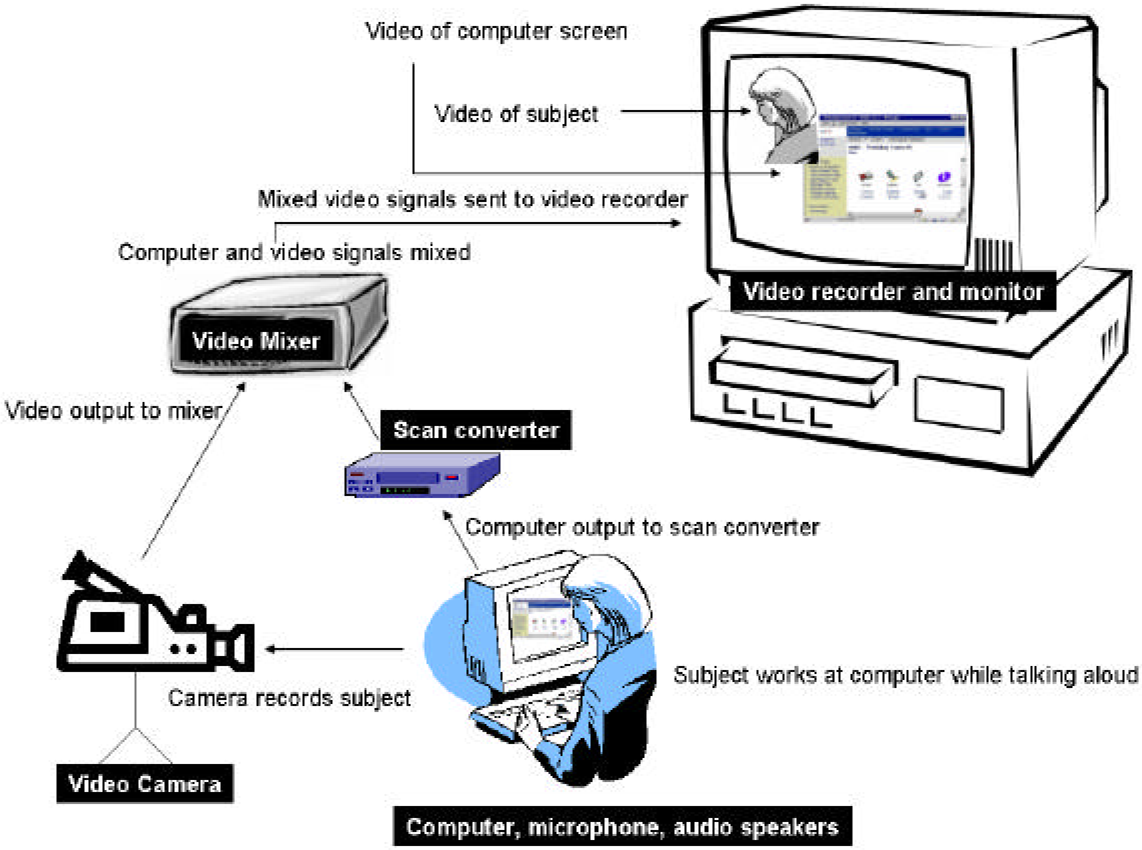

Figure 2. Video Split-screen Recording Process

Materials

The researchers created a web site that provided an overview of the study and instructions for completing it. They chose 11 of the 26 instructional videos for review because the selected videos represented fundamental WebCT components. Video topics included:

- Logging into WebCT
- Modifying headers and footers
- Communication Tools Overview Part 1
- Communication Tools Overview Part 2
- WebCT Mail Overview
- Sending Mail through WebCT
- Using Bulletin Boards Part 1
- Using Bulletin Boards Part 2
- Using Bulletin Boards Part 3
- Starting Chat
- Using Chat

Prior to beginning the study, trainees completed a pre-usability survey that assessed their familiarity with various WebCT components. Trainees rated their familiarity on a 7-point scale from 1 (Completely Unfamiliar) to 7 (Very Familiar). They viewed each of the 11 videos, in any order of preference. After viewing each video, trainees practiced the WebCT function or component they just viewed. When practicing, the researchers asked them to think aloud or verbalize what was going through their minds. After practicing, trainees completed a short WebCT Function survey, which presented 7 attitudinal statements to be rated from 1 (Strongly Disagree) to 7 (Strongly Agree). Once trainees watched all 11 videos, practiced them, and completed their respective function surveys, they received a post-usability survey that presented identical questions to those of the pre-usability survey. It took each trainee approximately two hours to complete the study.

The five trainees who completed all evaluation tasks were undergraduate students employed at the Media Center. Most indicated that they were computer familiar but had little or no experience with WebCT.

Results

Table 1 shows how familiar the trainees were of the WebCT components before and after the video training. The higher the average rating, the more familiar the trainees were with the specific component (the scale ranges from 1 to 7). Separate t-tests for dependent or paired means were conducted for each WebCT component. At a significance level of .05, results indicate that the trainees became significantly more familiar with the components after the video training. Table 1 also shows that the trainees were slightly familiar with the WebCT in general and with logging into the WebCT before the training, but were completely unfamiliar with the specific WebCT components.

WebCT Component	Before Video Training	After Video Training
WebCT in general	2.60	5.60
Logging into WebCT	3.60	6.80
Changing WebCT password	1.80	5.20
Modifying header/footer on the WebCT homepage	1.40	7.00
Reading a message in a WebCT discussion forum	1.40	5.80
Posting a message to a WebCT discussion forum	1.40	5.80
Reading a message with WebCT email	1.40	6.40
Posting a message with WebCT email	1.40	6.40
Accessing WebCT chat rooms	1.40	6.40
Using WebCT chat rooms	1.40	6.40

Table 1. Familiarity with WebCT's Components Before and After the Video Training

The trainees' evaluations of the eleven videos were averaged per evaluation item and are shown in Table 2 below. For each item, the trainees gave very positive evaluations of the videos. The higher the average rating, the more positive the evaluation (on a scale of 1 to 7).

Evaluation Item	Average Rating
No problems accessing the video	6.76
No problems using and viewing the video	5.95
The video was easy to understand	6.33
The video was well-paced	6.44
The video helped in learning about the specific WebCT function	6.59
The video format was the best way of learning about the specific WebCT function	6.62
Would recommend that others use the specific video	6.40

Table 2. Trainees' Evaluations Across the Training Videos

The trainees' evaluations of each instructional video were obtained by averaging their ratings across the seven evaluation items. The average ratings per video are shown in Table 3 below. The trainees gave very positive evaluations for each video. The higher the average rating, the more positive the evaluation (on a scale of 1 to 7).

Training Video Title	Average Rating
Logging into WebCT	6.11
Modifying headers and footers	6.17
Communication tools overview (part 1)	6.29
Communication tools overview (part 2)	6.54
WebCT mail overview	6.69
Sending mail through WebCT	6.69
Using bulletin boards (part 1)	6.37
Using bulletin boards (part 2)	6.57
Using bulletin boards (part 3)	6.40
Starting chat	6.51
Using chat	6.49

Table 3. Trainees' Evaluations of the Specific Training Videos

Trainees Commentary

Overall, trainees had few general comments about the videos. Two individuals wrote the following comments on the pre-usability survey:

- *I did a little with WebCT questions over in the Media Center.*
- *I don't know anything about WebCT so it will be nice to learn.*

The same two individuals wrote the following comments on the post-usability survey:

- *I don't feel I learned much.*
- *This was fairly easy to understand. Because the video was sometimes fuzzy it was hard to see everything that was going on. I feel like I have a good grasp of the beginnings of WebCT and could probably figure out more things on my own.*

It is difficult to ascertain whether the trainee who wrote, *I did not learn much*, was commenting about the inability of the video training to facilitate learning about WebCT or that her learning did not increase because her skills equaled the level of mastery the videos sought to promote. Her ratings of post-usability survey items were high ($\underline{M}$ = 6.4) compared to her pre-usability survey ratings ($\underline{M}$ = 1.7), which suggests that she perceived her learning to have increased.

Trainees made 15 independent comments about the videos (see Table 4). Generally, the commentary reflected their concerns about the video images appearing fuzzy. Internet congestion periodically caused the video image to distort. Comments also point out that trainees preferred the videos to be short, helping them to avoid feeling overwhelmed. Lastly, commentary reflected that some trainees saw similarities between specific WebCT functions and third-party email software and, for at least one participant, this association fostered understanding of WebCT functions.

Training Video Title	Comments
Logging into WebCT	Improve the picture quality of the video. It was choppy and messy as it ran. It was difficult at time to see what was actually on the screen. It was fuzzy a few times but because the voice told me what was there, I knew what to expect. If possible it may be quicker to one-on-one demonstrations.
Modifying headers and footers	Good timing of the videos. They are not too long and don't make me feel overwhelmed. Because the screen is fuzzy it was hard to catch all of the information. There were several screens that were similar, but it didn't take too long to figure out.
Communication Tools Overview Part 1	This was less information to soak in. This was easier than the previous one.
Communication Tools Overview Part 2	This was easy to understand because it was just telling about the links and how they are similar to other things we use everyday.
Web CT Mail Overview	I think this is very basic, and I would expect most people to know it, but if they didn't this would help them. Again, this was easy to understand because it was an overview and because it works basically the same way email does.
Sending Mail through Web CT	This was easy to understand because it works just like regular email. Anyone who has used email will be able to understand it.
Using Bulletin Boards Part 1	Good timing on the videos. They are not long and don't make me feel overwhelmed. Because this is similar to email it is very easy to understand. It's still fuzzy at times.
Using Bulletin Boards Part 2	This was short and easy to understand.
Using Bulletin Boards Part 3	This worked well because it was explained twice. I could see what I was doing and it was immediately reflected on the screen.
Starting Chat	I have never been in or used a chat room so I don't know if this is similar but it was easy for me to understand.
Using Chat	This was easy to understand as well. It was similar to email and other functions on WebCT.

Table 4. Trainee Commentary About Instructional Videos

Discussion

Trainees' Use of the Videos

The researchers were in interested in examining how trainees used the instructional videos. They speculated that trainees might watch them while working in WebCT. For example, a trainee developing content in WebCT could open two browser windows, one of which contained a video and the other the WebCT workspace. He could then watch a video as needed while working.

Overall, trainees did not use the videos when working. They watched a video and, after it ended, opened the WebCT workspace to perform tasks without returning or reviewing the video. In a few isolated instances, they left the WebCT workspace to review a video only when an alternative solution to a task could not be found. When encountering a problem, trainees attempted to find a solution within the WebCT workspace (e.g., clicking WebCT options, etc.) prior to reviewing a video.

Trainees' Reactions to the Videos

Trainees perceived that their learning increased as a result of the instructional videos. From the video recordings, the researchers made two observations that appear to support this perception. First, trainees, when performing WebCT tasks, did so in the same sequence and using the same input information as presented in videos. Second, there are several functions in WebCT that, in the researchers' view, are not obvious to users. When the videos presented such tasks, trainees performed them. For example, the chat room video demonstrated how to send a private chat message, a feature not always apparent to users. When trainees performed tasks associated with the chat room, they each sent a private message. Had trainees not viewed the video, they would not have known about this task and how to perform it.

Trainees' perception that they learned from the videos, their high ratings of them, and the researchers' observation pertaining to the potential of the videos to support learning suggests that this mode of WebCT training is beneficial. Moreover, the videos can be created in a short development cycle without excessive time demands being placed on the developers.

The Video Split-Screen Evaluation Method

The researchers observed that the video-spit-screen evaluation technique provided several advantages. It enabled them to trace (visually and aurally) the actions taken by trainees and to monitor their use of the Web-based videos, including time on task, navigation of landscape, and options selected. At one point, a trainee could not get a WebCT chat room to open. Using the video, the researchers retraced the trainee's actions. There were able to view his verbal and non-verbal response and frustration with being unable to open the room. They reconstructed the actions he took attempting to open the room and the length of time he spent on this task before asking for help. They were also able to observe distractions or the series of actions that led to unsuccessful results and to make informed judgments (based on verbalizations) about the trainee's decision making.

The researchers felt that the video-split-screen technique was a useful data collection method but they noted three disadvantages. First, it requires evaluators to invest much time in data analysis. The split-screen method collects a large amount of data in multiple media formats. Proper analysis of them requires time, which may be prohibitive for some Web developers. Second, the approach requires specialized video and computing hardware that some developers do not own. Third, untrained evaluators need guidance or training in how to conduct evaluations. Only after a review of the video recordings did the researchers realized the extent to which their comments served as prompts to trainees and, in some cases, directed their actions. Untrained evaluators must ensure their questioning and prompting do not lead users.

Summary and Further Research

As described in this paper, the instructional video training appears to be a viable WebCT resource. An extensive development effort

was not needed to produce a worthwhile product that is easily modified and updated. These facts coupled with trainees' positive reactions to them suggest that the videos hold potential for training.

All the videos used in this study were streamed, which worked well since trainees had fast Internet connections. However, as training audiences extend to off-campus locations, slow Internet connections will, to a great extent, prohibit video training. Alternative delivery formats such as DVD and CD-ROM will be needed to reach geographically dispersed trainees.

This study was an initial attempt to observe trainees using and reacting to selected instructional videos and, in this regard, the video-split-screen technique yielded much data. The work presented here needs to be extended to more fully analyze the information collected and its implications for the design and delivery of video training. The video-split-screen technique presents the possibility of making more in-depth analysis of not only software evaluations but trainees' information processing and decision making as they are engaged with software.

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A Study Proving Effective Intranet Usage Improves Performance

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Abstract

Eighteen students were equally divided: Group A had textbooks while Group B did not have textbooks. "A" learned the course material via the text and lectures. "B" accessed instructor notes, lecture slides, and future probable test items via the instructors' Intranet program called "Blackboard." Prior to each examination, the instructor presented key words that had been thoroughly discussed. The students had to explain each item in one sentence demonstrating understanding. The midterm examination had sixty-two items valued at three points apiece, totaling 186. The average score for Group A was 132 while Group B averaged 164. On the seventy-item, 210-point final examination, Group A averaged 156 while Group B averaged 188 points. Hence, using different approaches for student learning does make a difference. Providing student access via an Intranet to the instructor's material and allowing pre-lecture knowledge of probable examination items significantly improves examination results and student learning.

Introduction

Normally, all students are taught and treated equally to avoid any hint of discrimination in the classroom. Those students in grammar school, however, are often subdivided into groups or categories based upon their level of knowledge, skills or ability to learn. Then the teacher endeavors to teach the students according to their level or group. Evidence[1,2] has shown this method to be quite successful even though the students in the lower level groups may only be expected to learn a small percentage of those in the highest group. The students are graded based upon the teacher's expectations for those within each distinctive group.

Other studies concerning group subdivisions in the classroom deal with what is called the "self-fulfilling prophecy."[3] In these cases the teacher does not actually subdivide the students and usually believes he/she actually treats all the students equally. But, mentally, those students believed to be superior are actually dealt with differently and their work performance is measurably better.

No previous studies can be found where a class of "equally qualified" students is taught identically but pre-class information differs between groups of students. Such a study was undertaken and the results are here in reported. Eighteen senior or graduate students were enrolled in the "Organizational Effectiveness" course, Spring 2000, at Arizona State University. This course investigated all aspects of human behavior in organizations, relevant theories to help interpret and understand such behavior, and probable effectiveness of both the organization and individuals. The author, a visiting professor at Arizona State University, discovered on the first night of class that the students were equally divided: nine students already had their textbooks by the same name as the course and nine students had not purchased their texts yet. This was an ideal situation for this research project although it may be classified as controversial. Another commonality was that both groups were equally comprised of one mid-twenties full-time graduate student and eight adult learners averaging thirty-two years of age and employed.

The class was informed of the overall objectives of the course and the andragogy method to be used throughout the semester. The instructor would use extensive PowerPoint slides that directly corresponded to the textbook content. Rather than using the typical lecture mode, an open discussion methodology would be followed. Through this discussion each student should master the true meaning and possible applications of each topic area. In fact, they should be able to thoroughly explain each topic using simple and easily understood language. This technique supports the instructor's belief "If the students have not learned, the instructor has not taught," and his definition of communication that is "The equal responsibility of both the sender and listener for the guarantee of mutual understanding." The students were also informed that their mid-term and final examinations would consist of key topical words or names of individuals discussed in the class. They would have to thoroughly define or explain each item in one sentence without using a typical textbook "What" answer. In their responses they would have to convey complete understanding of the word, topic or person. Further, during the week prior to each examination, the list of words and names would be presented. The class would approve of each item for inclusion in the examination. The basis for inclusion or omission would be the thoroughness of discussion during the class sessions. If a majority of the students voted in favor of an item, it was included in the examination.

Dividing The Groups

The nine students who already had their textbooks were not told anything unusual about their expectations. The course would follow the thirteen chapters in the 600-plus-page textbook. They were to read the material prior to each class so they would be prepared for discussion. They would notice that all the PowerPoint slides used in the class corresponded to similar material in the textbooks; however, not all the tables, figures, charts, etcetera would be used. The nine students who did not have their textbooks were given two options: (1) Buy the $121.00 book and learn from it as usual or (2) choose not to buy a textbook and obtain the course material from the instructor's Intranet "Blackboard" site. They would be able to access the instructor's presentation and discussion notes, copies of all the PowerPoint slides and a listing of the key topical words and people prior to each class session. All nine students opted for using the Intranet. They were then provided with confidential access codes and information sheets explaining how to use the "Blackboard" system.

The Blackboard System

Blackboard CourseInfo[tm4] is an online teaching and learning server software product. Its purpose is to provide distance learning as an enhancement to traditional classroom instruction. Figure 1 shows Blackboard CourseInfo's four core features.

<u>Content Management</u>:

Posting course documents and assignments, staff information, and incorporating files from Microsoft Word, Excel or PowerPoint.

<u>Communication and Collaboration:</u>

Instructor and student interaction, Mutual learning via discussion boards, real-time chat opportunities, and virtual office hours.

<u>Assessment:</u>

Create tests, quizzes and surveys, Password-protected examinations, and Performance feedback.

Administration:

Instructor Control Panel access, Control of course content, communication, assessment, and user management via security permissions, and tracking student usage

Figure 1. Blackboard CourseInfo Core Features

The instructor used all of these options other than Assessment since only one-half of the students had access to this Intranet information. All course information was provided using this site including the syllabus, course purpose and objectives, schedule, PowerPoint slides, discussion notes, key words and people as probable examination items and other pertinent student information. Grades and class ranking was included. A major feature of BlackboardCourseInfo that was a great benefit to the instructor was the virtual office hours. Eight of the nine students using this system were full-time employed and were often unable to schedule meetings with the instructor. They regularly used the virtual meeting aspect of the system, that was a confidential threaded discussion board one-on-one "chat."

The Mid-Term

During the week prior to the mid-term examination the instructor presented all the key topical words and people that had been discussed since the beginning of the course. Each item was again considered, questions pertaining to each were answered, and the students voted on each items' inclusion or omission to the test. The majority ruled. If one-half voted to omit an item, it was not included in the examination. The remainder of the items constituted the test. The students knew the procedure and scoring for this examination. They had to demonstrate their degree of "understanding"' of each item in one sentence. A textbook "What" answer would not garner any points since it would not show understanding.

The mid-term test consisted of sixty-two items each having a value of three points. Therefore, the total points for the mid-term examination was 186. The two groups were labeled by the instructor Group A, the text book group, and Group B, the Intranet group. Table 1 shows the mid-term test results.

	Total Possible	Average Score	%
GROUP A	186	132	71
GROUP B	186	164	88

Table 1. Mid-term Examination Scores

Group B did significantly better than Group A by an average of thirty-two points. Also, the range of scores differed greatly for the two groups. Group B ranged from a low of 153 to a high of 183; a difference of thirty points. Group A had a low of 96 and high of 154 for a range of fifty-eight points. The instructor's initial prediction based upon andragogy principles was accurate. Students who can organize and plan their own learning, with guidance, will do better than those who are required to follow a prescribed pedagogy method: read, take notes, memorize, and then forget following the examination.

At the next class session the mid-term examination results were told to the whole class. The instructor informed the students in Group A about Group B and how they were learning. The instructor avoided uproar, or charges of discrimination, by assuring all Group A students that their examination scores would be adjusted at the end of the semester following the final examination. However, they were encouraged to excel because they had a lot of points between themselves and those students in Group B. None of the students complained because of the assured adjustment with a guarantee of fairness.

Final Examination

The results of the final examination were almost identical to the mid-term examination. There were seventy items approved by the class. Again, each item was valued at three points for a total of 210. Table 2 shows the results for the two Groups.

	Total Possible	Average Score	%
GROUP A	210	156	74
GROUP B	210	188	90

Table 2. Final Examination Results

The average difference between the two groups was identical - thirty-two points. The range for Group A was much less than in the mid-term examination. Group A scores ranged from a low of 142 to a high of 178 for an overall range of thirty-six. Yes, the lowest and highest Group A students were the same on both the mid-term and final examinations. The range for the Group B students was much narrower: a low of 178 and a high of 200.

Table 3 shows the combined results of the mid-term and the final examinations. Also shown are the adjusted Group A scores. The instructor added thirty points to each student's mid-term and final examination scores.

	Total Possible	Average Score	%
GROUP A	396	288	73
GROUP B	396	352	89
GROUP A (Adjusted)	396	348	88

Table 3. Overall Examination Results

The instructor equalized the scores as closely as possible. The Group A student who had the high-test score in that group was within thirty-two points of a perfect score on both the mid-term and final examinations. That student, incidentally, completed the course with the highest test score average. The applied adjustment and exactly how it was reached was thoroughly explained to the students. They all expressed their satisfaction.

Conclusion

The results of this study are highly conclusive even though the sample size was quite small. Different approaches for student learning does make a difference. Those students who had access via the instructor's Intranet site and could utilize actual course material scored significantly better than those students who followed the typical "learn from the textbook" approach. All students participated in the discussions and helped equally to determine examination content. But, those students who had access to the instructor's discussion notes and prior knowledge of probable examination items before each class could isolate their concentration on the most pertinent and valuable content. Their learning was under their individual control.

Although the sample size of this individual study was quite small, the author feels quite strongly about these results and his personal experiences such that he strongly recommends instructors reevaluate how they are providing learning opportunities for their students. With an Intranet system similar to Blackboard, the burden of learning is transferred to its rightful source with the students. Another benefit is the virtual office hours utilizing on-line one-on-one chat room capabilities. This student preparation process can be used for virtually every course regardless of its content. The ultimate objective is for the students to learn at their maximum potential.

A word of caution must be given, however. Any instructor wanting to a similar study must guard against any possible discriminatory practices. Any and all groups must be treated equally in the final grading.

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Blackboard CourseInfo; www.blackboard.com

Integrating Assessment and Research Strategies On a Large Development and Research Project: Kids as Airborne Mission Scientists (KaAMS)

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Abstract

Combining assessment and research components on a large development and research project is a complex task. There are many descriptions of how either assessment or research should be conducted, but detailed examples illustrating integration of such strategies in complex projects are scarce. This paper provides definitions of assessment, evaluation, and research and illumination on how to strategically integrate and manage assessment and research activities by providing examples of tools used to develop and manage a comprehensive assessment and research plan for Kids as Airborne Mission Scientists (KaAMS), a large instructional development and research project.

Introduction

Kids as Airborne Mission Scientists (KaAMS) is a large development and research project funded by the National Aeronautics and Space Administration's (NASA) Leading Educators to Applications, Research, and NASA-Related Educational Resources in Science (LEARNERS) project. The purpose of the KaAMS project was to develop a series of teacher resources, framed in interdisciplinary problem-based learning approaches integrating authentic and ill-structured problem situations, inspiring teachers to inspire students to pursue the sciences. The goal of the project was to develop *informed* instructional materials and *assess* their impact on the target audiences, middle school teachers and students. Thus, the project proposal included a strong commitment to formative and summative evaluation as well as a research component.

Definitions

Assessment is an umbrella term that refers to the systematic study of a problem or innovation to make effective decisions about what should happen (Rossett, 1987). In the case of the KaAMS project, the assessment plan defined the objectives, strategies, tools, and protocols used to collected formative and summative feedback.

The formative evaluation component of the assessment plan answered the question 'how are we doing?' as instructional materials were being developed (Morrison, Ross & Kemp, 2001). The focus of formative evaluation was on measuring the effectiveness, efficiency, usability, and acceptability of the material produced so that sound instructional design decisions could be made as the materials were developed and finalized. Feedback collected during formative evaluation served the function of informing the development team how well each of the instructional materials were serving the instructional objectives and what should be done to enhance them.

The summative evaluation procedures were designed to answer the question 'how did we do?' after instructional materials had been implemented with the target audience (Morrison, Ross & Kemp, 2001). Summative feedback focused specifically on the degree to which the major instructional outcomes were attained as a result of using KaAMS materials. Summative evaluation addressed (1) reaction, (2) learning gains, (3) performance changes, (4) education system changes, and (5) impact on the greater society. This feedback was useful in developing implementation plans and supporting materials to train new teachers in the use of KaAMS materials.

Research, on the other hand, is a process of identifying something unknown and then collecting data to make it known (Gall, Borg & Gall, 1996). In the case of KaAMS, the research components focused on analyzing the effect that using KaAMS had on the stakeholders in the middle school learning environment. For example, it was unknown how teaching strategies would be affected by introducing KaAMS into the classroom or whether the use of these materials would affect student interest in pursuing science. Answering such questions can help researchers develop a better understanding of the types of materials and activities that affect instructional and learning processes.

Thus, the purpose of assessment is to gather feedback that will inform the instructional design process. The dangers of having incomplete and poorly thought out assessment strategies are that either required feedback is not collected or time is wasted collecting feedback that is not important to design-enhancement decisions. Thus, the focus of a good assessment strategy must include plans and instruments for collecting feedback that is essential to drawing conclusions about what is needed to develop great instruction. The purpose of research is to gather data on the impact that instructional materials have on stakeholders and the instructional and learning environment. Poor planning of the research data collection process can result in obsolete data, lost opportunities to collect needed data, or data collection conditions that interfere with gathering reliable data. Thus, strategic collection of research data must also be tied to the development process, based on the key research questions, provide flexibility for adjusting to new learnings during product development phases, and seek data that can test theoretical assumptions.

Although assessment and research literature provides guidelines to develop, manage, and conduct assessment or research, comprehensive examples illustrating how to integrate assessment and research strategies, methods, and tools could not be found in the literature. Published literature on large-scale development and research projects usually contained only brief descriptions of certain components of assessment and research often neglecting to provide detailed descriptions of the relationship among development cycles, feedback and data collection procedures, and assessment and research tools. Therefore, decision-making about design and implementation issues can be problematic if the right amount or right kinds of feedback and data are not collected. Examples that illustrate the integration of assessment and research strategies and tools are scarce. Sharing such examples is therefore beneficial to others developing comprehensive and targeted assessment and research plans. The remainder of this paper will describe and provide examples of the tools and procedures developed to manage and conduct assessment and research on the KaAMS project.

Strategic Planning of Assessment and Research Cycles

The challenge in creating a strategic approach to assessment and research began with identifying the formative and research needs of the project. The literature on instructional development formative and summative evaluation provided guidelines for determining the types of feedback needed to develop sound instructional materials (Dick and Cary, 1985). The scope of the KaAMS project helped to determine who, e.g., teachers, administrators, students, curriculum specialists, would best be able to provide such feedback. Thus, during the development of the KaAMS lesson plans feedback was sough from middle school administrators, teachers, and students on the layout of the material, background resources, terminology, appropriateness of activities, time dedicated to preparation, impressions after using the materials, and thoughts on what worked and what did not during the use of the materials. This feedback was gathered during and immediately after the initial classroom testing of KaAMS.

The research questions were drawn in-part from the purpose of the grant, a literature review on problem-based learning, technology integration in the schools, and career development in adolescents and in-part based on the researchers interests. The research questions probed for understanding on the effects of KaAMS on: (1) teachers use of KaAMS and NASA resources in their classrooms, (2) changes in teaching practices during and after using KaAMS materials, (3) changes in students' success rates in science, (4) changes in students' interests in pursuing science, and (5) diffusion of KaAMS and NASA materials to the surrounding educational environment.

Three cycles of development and data collection

Being a large development project, lasting three years and consisting of collaborations among two major universities, several NASA scientists, and several schools, the KaAMS products were developed in three cycles: alpha, beta, and final versions. The frameworks for the PBL units and major lesson plan components were developed during the alpha cycle. The alpha version was developed based on collaboration among the KaAMS project team that included a group of advising middle school teachers who reviewed and classroom tested the KaAMS materials. Assessment of the alpha materials focused on the appropriateness of the level of content and activity for the students, background information and instruction for teachers, and general organization of lesson plans and associated lesson components.

The beta cycle focuses on using developing a beta version of KaAMS that incorporates learnings from alpha testing, including modifications needed to activities and development of support materials to meet the needs of teachers. Beta testing is conducted with a new set of teachers from a broader group of teachers and students spread across three states. Beta testing focuses on the usefulness of the completed product and how teachers integrate the lesson plans or lesson components into their curriculum. This feedback helps to finalize the KaAMS products and teacher support resources and develop national distribution plans. Simultaneously, research data were, or will be, collected to establish measurement baselines and gather further data on the effects of KaAMS on teachers, students, and the surrounding community. During Alpha testing the research instruments, protocols, and logistics were be tested.

The assessment and research matrix

The first step in developing the overall assessment plan was to document and examine the assessment and research needs. The assessment and research questions were placed in a matrix to develop a strategic view of the feedback and data requirements for the project. The formative and summative feedback needs were cross-referenced to the data collection instruments and questions by subject, e.g., teacher, student. See Table 1.

Table 1. Example from KaAMS Research and Assessment Matrix: Lesson Plan Development – Formative Evaluation

Lesson Plan Development - Formative Evaluation				
Stakeholders/ Instruments / questions	impressions of layout, terminology, etc. of lesson plans	value / needs of background resources	connections to the curriculum, terminology	value / usefulness / appropriateness of activities and resources
TEACHERS				
TAP A initial interview				
Teacher background	Q4-5			
Curriculum connections			Q1-3	
Lesson plan impressions	Q6-7			Q8
Background content		Q10-13		
Classroom use	Q15			
Discuss KaAMS w/others				
LP Follow-up survey				
lesson used		Q4		Q5
resources used				Q8-9
classroom description during lesson		Q18	Q17, Q23-24	Q19-22
student success				
STUDENTS				
Student focus groups	X	X	X	X
Student classroom documents		X		X
Student journals		X		X

* B=baseline, A=immediately after use, L= long-term follow-up, 1 to 6 months after use P-During prep, Q=question

The research questions were also cross-referenced to the data collection instruments and questions by subject, e.g., teacher, student. See Table 2.

After cross-referencing all of the feedback and data needs by instrument and stakeholder the matrix was examined for gaps and overlap. Instruments and protocols were adjusted to collected feedback and data that were not accounted for in the matrix. For example, it was found that student opinion and artifacts were gathered to assess student success rates, but teacher feedback was not gathered on student success. Questions were added to interview protocols to gather such feedback.

Analysis of the overlaps indicated that there were several instruments and questions gathering feedback on the materials. Since this goal of the project was to develop new instructional materials it was agreed that the level of overlap, especially since feedback was from multiple perspectives of the teachers and students, was appropriate. To ensure that the data collection was not too obtrusive to the learning environment, the next step was to plan the timing for administration of the data collection instruments and protocols.

The assessment strategies protocols called for continual gathering of feedback from teachers and students through multiple strategies, e.g. surveys, interviews, and observations. The KaAMS product development plan laid out the calendar timing for the development and testing of each component of the instructional materials. Examining each instrument and protocol provided an estimate of how long each stakeholder would be required to provide solicited feedback and data. Thus, the timing, by calendar date, and timing in terms of stakeholder commitment in providing feedback through the various instruments were examined. Time frames were established for administering data collection instruments based on the project development timelines and collection patterns for the most appropriate data that would be least invasive to those involved. These estimated timelines were added to the KaAMS Research and Assessment matrix. See Table 2, freq columns.

Table 2. Example from KaAMS Research and Assessment Matrix: Research

Stakeholders/ Instruments / questions	How are teachers using KaAMS and NASA resources?	* freq	How are teachers changing their teaching practices?	* freq	How are student success rates in science changing over time?	* freq	How are student levels of interest in pursuing science-related career changing over time?	* freq
KaAMS Research								
TEACHERS								
Electronic survey								
demographics			Q103, Q114-115, Q122-136	BAL				
teacher attitude			Q1-31	BAL				
percept. of env. for web			Q32-52	BAL				
methods of teaching			Q53-78, Q112-113	BAL				
Resource use			Q79-102, Q104-110, Q111	BAL				
Importance of NASA, Aero, RS to curric.			Q116-121	BAL				
LP Follow-up survey								
lesson used								
resources used	Q8-9	A						
classroom description during lesson			Q10, Q16, Q27	A			Q19-22	A
student success					Q13, Q15	A		
Classroom Observations	X	D					X	D

* B=baseline, A=immediately after use, L= long-term follow-up, 1 to 6 months after use P-During prep, Q=question

One additional benefit of the strategic matrix was in providing an overall picture of the project development, assessment, and research components. Thorough review of the matrix provided insights into the complexity of the research agenda. This prompted the development of a strategy to use the alpha testing cycle to test the research protocols. This would allow the team to refine logistics for data collection and identify initial findings related to the effects of using the KaAMS materials with middle school populations. However, it is important to report such findings with caution, since effects may be related to additional attention from product development teams.

Additional Planning and Managing Tools

The strategic planning matrix provided the framework for a comprehensive Assessment Plan to be used by the project team to manage the assessment and research processes. The components of the Assessment Plan included text and graphic representations of the overall assessment strategy, teacher advisory panels for alpha and beta testing, roles and responsibilities of assessment team members, components of each evaluation and research procedure, development and data collection timelines, selection criteria for participants, forms for tracking procedural issues, copies of all instruments and protocols, and human subjects approval forms. The Assessment Plan was developed so that each component was tied to the research matrix supporting the data collection needs while keeping the amount of disruption to subjects at a minimum.

The strategic planning matrix also provided the framework for creating a database for all data collected during the assessment and research phases. In this case, a spreadsheet was developed with multiple worksheets. Each worksheet was titled based on the instrument, stakeholder and type of data it collected. This naming structure ultimately helped in the data analysis processes.

The final assessment and research report was also based on the strategic planning matrix. The matrix provided an overview of the data requirements in response to the evaluation and research questions. This overview was used as the planning structure to analyze the data collected and to report on findings based on the project questions. The final assessment and research report included text and graphic representations for an executive summary of the assessment and research findings, a short summary of the project goals and assessment and research objectives, summary of the formative and summative evaluation feedback and recommendations for each component of the KaAMS material, tables and figures describing results, summaries of the observations and data collected from each classroom, baseline and subsequent description of each stakeholder in the classroom trials, and appendices that described each of the lesson plans tested, detailed notes from observations, interviews, and focus groups, and selected printouts of data analysis on stakeholders. Thus, the information in the summary report was linked to the other assessment and research tools developed for the project, based on the framework established in the strategic planning matrix.

Conclusions

Combining assessment and research components on a large development and research project is a complex task. Creating strategic planning tools can help visualize the feedback and data needs and provide a framework for creating overall assessment and research plans, data collection schedules and instruments, and summary reports.

During KaAMS, several levels of assessment and research were conducted and data were collected from several stakeholders. A planning matrix was created to avoid over- and under-collection of data and assure that the appropriate data were collected. The matrix provided a strategic tool to help cross-reference the collection of different data, at different times, from multiple stakeholders. It helped to identify weaknesses and strengths of the assessment strategies and guided further development of instruments and protocols. The key benefit of such as matrix was in its value to provide a framework for creating an overall Assessment Plan that helped coordinate assessment and research team members during data collection, data analysis, and reporting. This tool, thus, helped to plan and manage the complex task of gathering the right type of feedback and data, at the right time, from the right stakeholders during a large, multi-year development and research project.

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How and Why Students Play Computer-Based Mathematics Games: A Consideration of Gender Differences

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Abstract

This research was recognized with the 2000 Robert M. Gagné Dissertation Award from the AECT Division of Instructional Development. The study, both qualitative and quantitative, focused on gender differences in the use of a computer-based mathematics game. High school level males and females were compared in their game-playing and learning strategies, motivation to use a computer-based mathematics game, beliefs about mathematics and computers, and mathematics performance. The evident gender differences and instructional design implications are discussed.

Introduction

When computer-based games are developed for learning, consideration must be given to gender. Males and females report different reasons for motivation to play computer-based games (Dempsey, Lucassen, Haynes, & Casey, 1997; Malone, 1981). Along with differing views for motivation, males and females report differences in the use of metacognitive and cognitive strategies. Metacognitive strategies are used to monitor and regulate progress toward a goal (Flavell, 1981). Metacognitive strategies are also known as comprehension monitoring strategies (Smith & Ragan, 1999). Cognitive strategies are strategies selected by learners to process information and solve problems (Gagné, Briggs, & Wager, 1992). Metacognitive strategies govern the use of cognitive strategies (Gagné, et al., 1992). Learners can examine their use of cognitive and metacognitive strategies to improve their performance in computer-based instructional games (Jacobs & Dempsey, 1993).

The now classic ARCS Model of Motivation (Keller, 1983; 1987a; 1987b) is relevant to the study of motivation and the use of computer games to motivate learners. The ARCS Model of Motivation includes four categories of conditions that affect the motivation to learn. The four categories are <u>attention</u>, <u>relevance</u>, <u>confidence</u>, and <u>satisfaction</u>.

In a frequently cited study of computer-based games, Malone (1981) proposed a theory of intrinsically motivating instruction. Malone developed his theory to include three categories: <u>challenge</u>, <u>fantasy</u>, and <u>curiosity</u>.
In this study, evidence emerged that fit with Keller's (1983; 1987a; 1987b) ARCS Model of Motivation and Malone's (1981) theory of intrinsically motivating instruction. Males and females reported different game-playing strategies and different reasons for motivation. Consequently, guidelines are needed for the design of computer-based instructional games that are appealing and motivating to learners regardless of gender. Finding exceptional ways to design and develop computer-based instructional games has the potential to assist all learners in improving their confidence in mathematics ability and beliefs about mathematics and computers.

Purpose and Scope of the Study

The purpose of this study was to compare high school level males and females in their game-playing and learning strategies and their motivation to use a computer-based mathematics game. In addition, males and females were compared in their beliefs about mathematics and the use of computers. Comparisons were made also for mathematics performance.

Gender differences in learning have been researched in various areas such as mathematics performance (Friedman, 1989; Hyde, Fennema, & Lamon, 1990), attitude toward mathematics (Hyde, Fennema, Ryan, Frost, & Hopp, 1990; Kaiser-Messmer, 1993), and attitude toward the use of computers (Shashaani, 1994; Taylor & Mounfield, 1994). Gender differences in the use of computer-based games, however, have not been examined extensively (Dempsey, Lucassen, Gilley, & Rasmussen, 1993-94). In a review of 51 instructional gaming articles (Dempsey, et al., 1993-94), the authors note that the articles were unclear in reporting learner characteristics such as cognitive style or demographics such as gender, race, and age. Along a similar line of thought, the American Association of University Women [AAUW] (1992) points out that research reports frequently refer to students without specifying gender and fail to explore links between gender and academic performance.

Method

Participants

The participant population included five ninth-grade classes of students (58 females and 52 males) enrolled in Algebra I at a private parochial school in the Southeast region of the United States. Entry to the school was arranged through a fellow graduate student who is an administrator at the school. The classes each had 19 to 23 students (<u>N</u> = 110). To assure confidentiality, an identification code number was assigned to all participants. Because the number of computers was limited to 17, participants were randomly assigned to work in pairs with a student of the same sex.

Facilities

Students played the game in the school library. The library had a separate room with 17 IBM-compatible PC computers. The computers were arranged in a rectangular shape facing the walls.

Instructional Materials

A commercially developed software program was used in the study. The software, produced by The Learning Company (1997), is called *Grade Builder Algebra 1* (1997). It includes a tutorial and two games related to the algebra topics. One of the games (*Soak Your Sibling*) was used in this study to review previously learned algebra topics. The Learning Company donated the software for this study. The software remained with the school upon completion of the study.

The treatment was the use of a computer-based mathematics game to review algebra topics. The participants learned the algebra topics two to three months before this study took place. The game questions included, for example, linear equation problems. For the linear equation problems, the participants identified where an animated character was hiding by typing the missing values of the line's equation.

Research Questions

Six major questions were considered. The first question on strategies was studied with the use of qualitative data. The second question on motivation was examined with qualitative data supplemented by quantitative data. The remaining questions were answered primarily through quantitative data with supplemental qualitative data.

Research Question 1: What strategies will be reported by males and females following the use of a computer-based mathematics game?

Research Question 2: What will males and females find motivating about a computer-based mathematics game?

Research Question 3: Will there be a difference between males and females in their beliefs about mathematics, controlling for prior beliefs, following the use of a computer-based mathematics game?

Research Question 4: Will there be a difference between males and females in their beliefs about the use of computers, controlling for prior beliefs and spatial visualization, following the use of a computer-based mathematics game?

Research Question 5: Will there be a difference in the scores of males and females on an immediate posttest, controlling for pretest scores, following the use of a computer-based mathematics game?

Research Question 6: Will there be a difference in the scores of males and females on a delayed posttest, controlling for pretest scores, following the use of a computer-based mathematics game?

Research Design

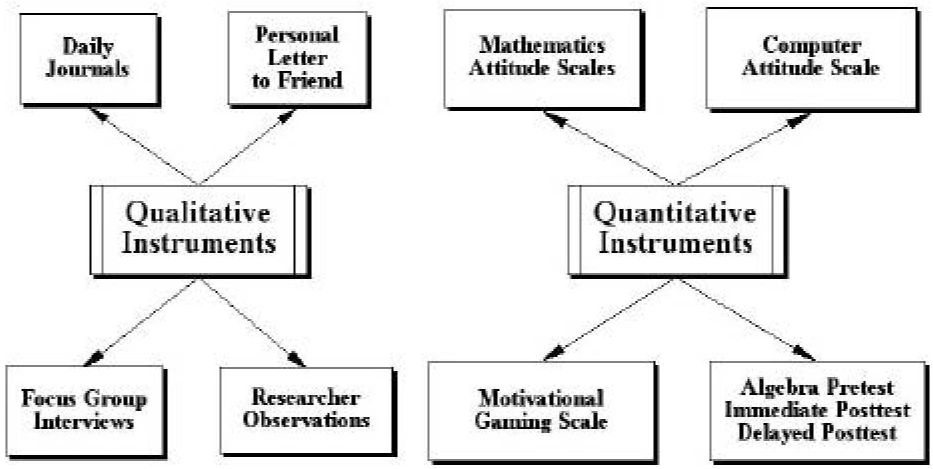
This study was qualitative and quantitative. The qualitative data included researcher observations and focus group interviews. Interviews are important because thoughts and feelings cannot be observed (Patton, 1990). In addition to the observations and focus group interviews, daily journals and personal letters written by students provided insight into the students' learning and game-playing strategies, as well as their motivation to play the game.

The quantitative data included results from the <u>Visualization in Two-Dimensions Test</u> (Flanagan, Davis, Dailey, Shaycoft, Orr, Goldberg, & Neyman, 1964), the <u>Fennema-Sherman Mathematics Attitudes Scales</u> (Fennema & Sherman, 1976), the <u>Computer Attitude Scale</u> (Shashaani, 1993), and a <u>Motivational Gaming Scale</u> (Dempsey, Lucassen, Haynes, & Casey, 1997). The Motivational Gaming Scale is based on Keller's ARCS Model of Motivation (Keller, 1983; 1987a; 1987b). The scale is a modification of Keller's Instructional Motivational Scale (Keller, 1987c). The Likert-type scale includes statements related to attention, relevance, confidence, and satisfaction. Pretest scores, immediate posttest scores, and delayed posttest scores provided reports of mathematics performance.

Combining methodologies and using multiple data sources is known as triangulation (Creswell, 1994). Triangulation helps the researcher to "cross-check" information and conclusions by using multiple procedures or data sources (Johnson, 1997). A graphic organizer for the instruments is displayed in Figure 1.

Independent and Dependent Variables
For the quantitative analysis in this study, the independent variable was gender. The dependent variables included beliefs about mathematics, beliefs about the use of computers, gaming motivation, mathematics performance on an algebra immediate posttest, and mathematics retention measured by an algebra delayed posttest. Spatial visualization was a covariate for beliefs about computers. Prior beliefs were covariates for beliefs about mathematics and computers.

Figure 1. Qualitative and Quantitative Instruments



Procedures

On the first day of the study, the participants remained in their regular classroom and completed an algebra pretest and the Visualization in Two-Dimensions Test (Flanagan, et al., 1964), The next day, the participants completed a demographic questionnaire, the Fennema-Sherman Mathematics Attitudes Scales (Fennema & Sherman, 1976), and the Computer Attitude Scale (Shashaani, 1993). The participants were randomly assigned to work in pairs with a student of the same sex in the computer laboratory. Four class sessions were devoted to playing the game. Near the end of the class session, the students completed a three-page Daily Journal form to describe their experience. The students described the strategies they employed, as well as elements they liked or disliked about the game. In addition, students described successful and unsuccessful situations, along with their attributions for success. A sample of the journal questions is shown in Figure 2. After the four days, participants again completed the Fennema-Sherman Mathematics Attitudes Scales (Fennema & Sherman, 1976), the Computer Attitude Scale (Shashaani, 1993), and the Motivational Gaming Scale (Dempsey, et al., 1997). The next day, the participants completed an immediate posttest on the algebra topics. Two weeks later, the participants completed a retention test on the algebra topics. Three days after the immediate posttest, the students participated in focus group interviews. For each of the five algebra classes, two separate focus group sessions were conducted. One focus group consisted of males only. The other focus group consisted of females only. Each focus group session lasted approximately 20 minutes. Upon arrival at the focus group session, the participants submitted a personal letter to a friend that described their experience with the game and the strategies they used.

Figure 2. Sample Questions from the Daily Journal

What steps did you take to play the game today? In other words, what was your Plan of Action?

Describe a situation where you were *most* successful today. Explain why you were successful.

What do you remember enjoying *most* today?

What do you remember enjoying *least* today?

Data Analysis

The statistical software *SPSS 6.1* (1994) served as the primary tool for the analysis of the quantitative data. Chi-square tests were used to analyze gender differences in the responses to the Demographic Survey and Game Survey Part I. Game Survey Part I was developed primarily to determine if students had played the game before and to see if the participants felt in control of the technical aspects of the game, such as using the mouse and keyboard. Descriptive statistics were used with the Fennema-Sherman Mathematics Attitudes Scales (Fennema & Sherman, 1976) and the Computer Attitude Scale (Shashaani, 1993). Analysis of covariance (ANCOVA) was used to examine differences between males and females in their beliefs about mathematics, controlling for prior beliefs. ANCOVA was also used to examine differences between males and females in their beliefs about the use of computers, controlling for prior beliefs and spatial visualization. ANCOVA was used to examine the algebra posttests. The algebra

pretest was the covariate. The Motivational Gaming Scale (labeled as Game Survey Part II) was examined with factor analysis. T tests were conducted for gender differences on the factor scores. Chi-square tests were used for a follow-up analysis on individual Motivational Gaming Scale items.
For this study, some of the statements were modified to be more specific to reviewing algebra with a computer-based game. The estimated reliability of the scale was .89 (Cronbach's alpha). In an earlier study (Dempsey & Johnson, 1998), the estimated reliability was .64 (Cronbach's alpha).

A qualitative software program, *QSR NUD*IST 4* (1997), was used in the analysis of the qualitative data. The acronym NUD*IST stands for Non-numerical Unstructured Data * Indexing Searching and Theorizing. The software can be used for coding data in an index system. When all the qualitative data were coded for this study, the resulting index system was exported to the software program, *Inspiration 4.0* (1992) in the form of an outline.

The coded qualitative data were submitted to a peer reviewer. As a result of the comments and suggestions from the peer reviewer, modifications were made to the coding. Peer review is a strategy used to promote validity in qualitative research (Johnson, 1997).

Results and Discussion

Strategies

Evidence emerged that showed differences in males and females and their reports of strategies. Females gave more evidence of using metacognitive, cognitive and cooperative strategies. Males gave more reports that they did not have a specified strategy. Both males and females showed evidence that their strategy was to challenge themselves.

Malone (1981) suggests that learners can be challenged by uncertain outcome. Malone recommends four strategies for achieving uncertain outcome: varying the level of difficulty, designing multiple-level goals, hiding information, and introducing randomness. The students discovered ways to vary the level of difficulty and make the game suitable for their skill level by selecting algebra problems accordingly. Multiple-level goals were reported by students whose strategies included working quickly, beating the timer, and solving the problem mentally or working the problem in their head.

The students demonstrated a connection between motivation and the use of strategies. Malone (1981) recommends motivating students to learn by presenting just enough information to make the learner's existing knowledge seem incomplete, inconsistent, or unparsimonious. The students demonstrated their ability to recognize when their existing knowledge was incomplete by reporting the use of metacognitive strategies. For example, one male wrote in his Letter to a Friend, "Every day before I played, I learned the formulas to the problems I was doing. This helped me understand the problem better when I played the game." A female student wrote in her Daily Journal, "Review the material since we have not looked at it in a while."

With respect to cognitive strategies, females (n = 34) gave twice as many reports as males (n = 17) for solving problems on paper. As a cooperative strategy, females (n = 16) showed a much greater use of comparing individual answers than males (n = 4). The cognitive and cooperative strategies appear to have a linkage. The linkage appears to be where females compared individual answers (a cooperative strategy) that they solved on paper (a cognitive strategy).

Motivation

In the analysis of motivation, categories emerged that fit with Keller's (1983, 1987a, 1987b) ARCS Model of Motivation and Malone's (1981) theory of intrinsically motivating instruction. Females showed higher motivation with respect to relevance of the game as a learning tool (e.g., finding the game helpful). In addition, females indicated higher motivation through satisfaction (e.g., finding benefit of examination review). Males were more highly motivated by challenge in terms of building self-esteem (e.g., achieving a high score). Both males and females showed evidence of gaining satisfaction from positive consequences (e.g., reporting the game as fun, enjoyable, good, or great). Both males and females were motivated by confidence generated by success opportunities (e.g., solving problems, learning new formulas).

Keller (1987a) points out that success opportunities promote confidence. Keller emphasizes the importance of allowing learners to have meaningful success experiences as soon as possible to stimulate continued motivation. Numerous citations in the Daily Journals illustrate the success of both males and females. The following quotes were written by female students in response to the question, "What did you enjoy most today?" "Figuring them out, finally!" "Finally figuring them out." "Figuring out slope and distance." "Knowing how to solve the problem." "Finding out we were right." "Learning how to do the problems." "Remembering how to do the problems." "Finally understanding slope-intercept." (The student drew a smiley face next to her response.)

Male students wrote similar responses in the Daily Journals to illustrate their success. The following quotes are examples of what they wrote in response to the question, "What did you enjoy most today?" "When I got this long problem." "Learning and solving problems." "Having more of a challenge by working all of the problems." "Figuring out the problems." "Answering problems correctly." "Learning a new formula." "Learning distance formula." "Remembering."

Both males and females indicated repetition as a problem with sustaining attention to the game. Males indicated a desire for instructional games to include elements of entertainment games, such as 3-D images and violent fantasies, to attract their attention. Although the issue of violence was raised only in the focus group interviews, ignoring the implications is difficult. The issue arose primarily in discussions of why more males play computer games and whether the game used in this study was appropriate for both males and females. The researcher presented no violence-related questions. The following dialogue illustrates the students' ideas about violent themes in games.

"Tell me what you think about the *Soak Your Sibling* game for males and females. Is it more interesting to males or females or both? " A female student said, "If they pulled out a Tommy gun, guys would like it more."

Similarly, in another focus group interview, one male said, “It needs to add some violence.” The researcher asked, “Violence? You think it needs more violence?” The student responded, “Yeah. Like a guillotine to chop off your head.” Another male offered a less violent solution by saying, “Males would like it more if it had sports.”

Beliefs About Mathematics and the Use of Computers

Before and after student use of the game, t-test results of the attitude scales showed that males were more likely than females to stereotype both mathematics and computers as male domains. Although the qualitative data from the focus group interviews gave some indication of gender-based stereotyping, both males and females gave evidence during the interviews that they did not hold stereotypical views about mathematics and the use of computers. Females also recognized that stereotypical views stem from societal expectations and are more often views that are held by males.

Mathematics Performance

The results did not show a statistically significant difference between males and females in their immediate posttest or delayed posttest scores. The results did not support the research hypotheses that males will score higher than females on an immediate or delayed posttest following the use of a computer-based mathematics game. The results on the delayed posttest, however, indicated a tendency toward statistical significance ($p = .070$) with females performing better than males.

Implications

Both males and females demonstrate the development of cooperative, cognitive, and metacognitive strategies when playing a computer-based mathematics game. The use of games, such as the one used in this study, may be disadvantageous to males, however. If males have more experience with computer-based games, especially violent games, they may be less likely to see the benefits of games to their learning. Females, on the other hand, may benefit from the use of this type of computer-based game because they are more likely to see the value of the game as a learning tool. The evident gender differences indicate the need to design games that are appealing to both males and females. The development of various game fantasies will allow students to make choices that are more relevant to the student. In addition, allowing students to choose the level of difficulty promotes challenge and success opportunities.

Conclusion

Both males and females are interested in the use of a computer-based mathematics game, although they take a different approach and have different reasons to engage in the game. Designing computer-based mathematics games that appeal to both males and females supports the learners’ development of cooperative, cognitive and metacognitive strategies. Games that are designed with varying levels of difficulty challenge learners to succeed without damaging their self-esteem. Designing games that challenge learners to succeed assists the learners in building confidence in their mathematics ability.

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Sister Mary Theresa Brentano, OSB's Innovative Use of Magnetic Audio Tapes: An Overlooked Story in the History of Educational Technology

Linda Herndon, O.S.B.

"The keenest disappointment of our trail blazing would be that we could not fit into the picture of new developments."
from Brentano's daily journal calendar, January 5, 1959

Introduction

In this paper, I tell the story of Sister Mary Theresa Brentano, O.S.B.'s (1902-1987) innovative use of magnetic audio tapes to provide instruction for students in grades K-12. From 1952 to approximately 1968, Brentano implemented, refined, and tested her tape teaching methods with special emphasis on individualizing instruction in the elementary school. Brentano's innovative tape teaching ideas are not mentioned in Saettler's *The Evolution of American Educational Technology* (1990), DeVaney's *Voices of the Founders: Early Discourses in Educational Technology* (*1996),* or Butler's *Women in Audiovisual Education, 1920-1957: A Discourse Analysis* (1995). In this paper I provide interpretive biographical look at Brentano's tape teaching innovation. I discuss her rationale for and implementation of tape teaching and share some of the successes and struggles of tape teaching. I conclude by discussing two ways my research into Brentano's individualized tape teaching innovation benefits the field of educational technology.

Sister Mary Theresa Brentano, O.S.B. was a Benedictine Sister of Mount St. Scholastica in Atchison, Kansas.[1] In June 1933, Brentano, a member of the Phi Beta Kappa honor society, received the first Ph.D. in English awarded by the University of Kansas ("City News," 1933). After receiving her Ph.D., Brentano returned to the college run by her religious community, Mount St. Scholastica College[2] in Atchison, Kansas, as head of the English Department.

Sometime during the 1947-48 school year, Mother Walburga (Anna) Franz, Prioress of St. Scholastica Priory, Covington, Louisiana, came to Atchison, Kansas, to confer with Mother Lucy Dooley, Prioress of Mount St. Scholastica, about the possibility of sending a few Sisters to Covington. Franz wanted some sisters from Atchison who had their Ph.D. to go to Covington to help the sisters maintain state certification of their school, St. Scholastica Academy, by teaching some classes to their sisters. Brentano was one of two sisters from Atchison who volunteered to go to Louisiana in the fall of 1948.

The Inspiration for Tape Teaching

Sometime in 1952 while she was principal of St. Scholastica Academy in Covington, Brentano and Franz went on a trip to New Orleans. While riding in a taxicab there, Brentano noticed that the cab driver could call his headquarters to get his orders to find out who to wait for and where. Brentano got the idea that if the taxi driver could talk over the intercom and communicate with headquarters, then why couldn't this same technology be used in a single classroom with the different students hearing the teacher whenever she talked to them. (M. P. Ege, OSB, personal communication, November 6, 1999)

With the full support of Franz, Brentano set about to make her germ of an idea for individualized tape teaching a reality. Having previously observed the use of tape recorders and earphones to teach graduate students foreign languages ("Classroom electron," unknown; Stoma 1957), she decided to use this technology to provide the individualized instruction that parents were requesting for their daughters and sons. Although we now think of individualized instruction as meaning each child is taught according to his or her needs, for Brentano individualized instruction meant that a child's individual needs were important, but for instructional purposes, the child is grouped with other children who have similar needs. She referred this method as "individualization within the group" (1959). Brentano described individualized tape teaching as "probably the greatest aid now available for taking care of individual differences in the classroom" ("Sisters Prepare Tape Recorded Lessons," 1954?). The huge increase in the student population as the Baby Boomers started school created a teacher shortage and individualized tape teaching was touted as a possible way to help to alleviate this problem.

Tape Teaching–What It Is and How It Developed

A class period taught using Brentano's individualized tape teaching methods was divided into three sections of about 20 minutes each (Keating, 1961). During the first section of the class period, the teacher introduced the class's topic. The teacher then divided the students into four ability groups. While three groups used earphones to listen to tapes prepared by their teacher on the topic, the teacher worked with the fourth group that needed extra help. The brightest students heard on tape how to apply what the teacher had presented. The average students got some clues or reminders about how to apply what was presented while the slow learners had the entire lesson repeated, possibly more than once (Stoma, 1957). The last section of the class period was a total-class discussion where students had a chance to share what they learned from listening to the tapes. A former tape teacher shared with me that Brentano encouraged her to make sure that the low ability students always had some information on their tape that the other groups did not have (T. Balot, personal communication, March 24, 2001). In this way, the lower ability students could always participate and contribute something special to the class discussion.

Ideally, only the teacher knew to which ability group she or he assigned a given student. The reason for this was to remove the stigmas that can go with the grouping of students (Stengren, 1958). These ability groups did not need to be the same for every subject (Dickerson, 1958). For instance, a student could be in one group for arithmetic and a different one for English. The teacher could change the student from one group to another during the school year and the student could also request to change groups (S. Ross & Kiester, 1958, and Brentano notes). From interviews with tape teachers, all shared with me that in practice students *did* know to which of the four groups they were assigned.

gure 2. First tape teaching console. St. Scholastica ademy. 1952.

In the fall semester of 1952, a class of primary student first used earphones and tapes in a room with 30 listening booths and six channels of tape (S. M. T. Brentano, O.S.B., 1962, p. 368) (See Figure 2). Brentano believed that providing primary grade children with the best education possible was important since that was where their foundation in education began (M. K. Taylor, OSB, personal communication, January 12, 2000) and she believed that “small pupils were being slighted in their American technological heritage” (Laube, 1958). Figure 2, the oldest dated photograph of tape teaching, requires some explanation. This photograph shows a six-tape console being used by a teacher. When Brentano originally started tape teaching, she used six different tapes. It seems that experience proved that three tapes were as effective as six and required much less preparation for the teacher. The photograph shows high school girls, not elementary school children, in the carrel-style listening booths. Several newspaper articles in the fall of 1954 (“Electronic Classroom,” 1954; “Sisters Prepare Tape Recorded Lessons,” 1954?; “Tape-recorders, books team up in first U.S. ‘Electronic Classroom’,” 1954) have photographs that show this classroom being used to teach primary grade girls and boys. Brentano coined the term *Electronic Classroom* to refer to this room since she said it did not seem appropriate to call it a laboratory with first and second graders using it (date unknown).

Brentano's individualized tape teaching innovation evolved with experience. One of the first additions to tape teaching was the use of a worksheet to accompany the tape. As Brentano explained (1962),

> On tape the child never merely listens. He will listen, learn, and on his worksheet record the fruits of his mental activities both for his own help in review and his teacher's evaluation of this achievement....On his worksheet he will likely be asked to write answers that relate the lesson to his past experience, to give the result of his observations, and to carry his observations forward until he can infer from facts some generalization or principle . . . and finally correct his paper by noting the answers which the tape will give him. (p. 369)

Since the six-track individualized tape instruction electronic classroom was popular with both teachers and parents, there was a need to create another tape teaching classroom. The second iteration of the tape classroom was built in 1953 and it provided a less expensive alternative to the original electronic classroom (See Figure 3). In this classroom, conduits that held the lines from the tape recorders extended between the rows of desks. While seated at their desks, the children plugged their earphones into a jack box in the conduit and could listen to the tape without having to be in special listening booths (date unknown).

Figure 3. Second iteration of tape teaching classroom. Sister Maris Stella Pravata (Maris Leitz) is the teacher. Date unnknown.

Figure 4. The third iteration of the tape teaching classroom. On Pravata's desk is a microphone and a switch box. Photo by Petit's Studio. Date unknown.

The third iteration of the tape classroom (See Figure 4) developed later involved the addition of an intercom system by which the teacher could contact an individual student without disturbing the rest of the class. Brentano described needing an intercom as a way to get the attention of an inattentive student as well as to determine if a student could properly hear the tape. The first intercom system allowed only one-way communication–from teacher to a student (Laube & Brentano, 1957). Figure 4 shows a tape teaching classroom complete with the microphone by which the teacher could contact individual students. To contact an individual student, the teacher had a set of switches that allowed her tap into the same line as an individual student.

Our Lady of Wisdom Hall–The First Electronic School

The success of tape teaching resulted in an increased enrollment at St. Scholastica Academy. In 1957 to provide more classroom space for the larger enrollment and to meet the needs of Brentano's developing tape teaching innovation, the Benedictine Sisters built Our Lady of Wisdom Hall. *Newsweek* ("Electronic classrooms," 1957, p. 99) referred to Our Lady of Wisdom Hall as "the first structure in the history of American education to be specially designed and pre-wired for electronic teaching." Our Lady of Wisdom Hall, a one-story, air-conditioned, three-classroom building, cost $75,000 of which $15,000 was for the electrical features ("Classroom electron," unknown). Two classrooms, that Brentano called Classroom Electron I, were somewhat traditional looking with individual desks and the other classroom, Classroom Electron II, had 32 individual recitation booths as well as desks. There was a fourth and much smaller room called the individual measurement room.

Classroom Electron I

At first glance, each of the two identical Classroom Electron I's looked like traditional classrooms (see Figure 5). One noticeable difference is that on the floor beside each desk is a recessed receptacle into which a student plugged in a set of earphones. This innovation, designed by Brentano, eliminated the raised conduits with wires in the aisles between the students' desks. The second special feature was that the teacher's desk was replaced by a special six-foot long console that includes four heavy-duty Viking-75 tape recorders ("Electronic age school," 1959), a set of control switches for each student's desk, and a headset with a microphone for the teacher (see Figure 6). The four reel-to-reel audio tape players allowed the teacher to present up to four different taped lessons at any given time. Besides the three tapes used for instructing three different ability groups, the fourth tape recorder was available for a variety of purposes: a special lesson for highly accelerated students, a remedial lesson, a make-up lesson replaying a tape missed a previous day, or as a replacement tape recorder if one of the other three recorders was not working correctly. The toggle switches shown in Figure 6 allowed the teacher to select which of the four tapes each individual student heard.

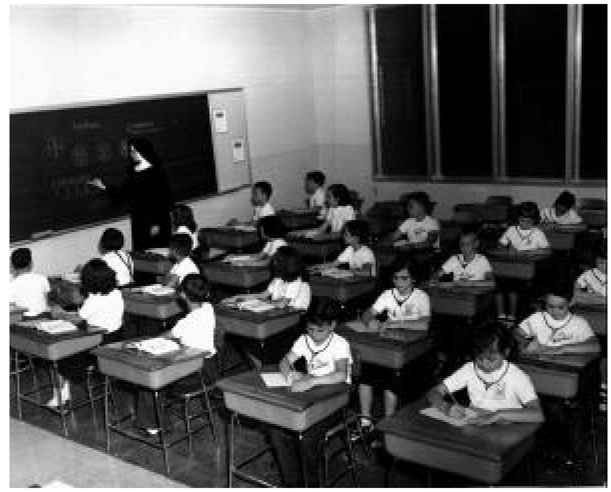

Figure 5. Classroom Electron I. While Pravata instructs some students others are using earphones for taped instruction. Photo by Petit's Studio. 1957.

Figure 6. Classroom Electron I teacher's console. Sister Anthony Balot (Toni) adjusts the switches to set which tape a student hears. Photo by Petit's Studio. 1957.

Clasroomsroom Electron II (or the Booth Room)

The single Classroom Electron II (or Booth Room) in Our Lady of Wisdom Hall was equipped with desks in the middle of the room and a total of 32 soundproof individual recitation booths along twosides of the room (see Figure 7). The desks permit the teacher to work with a small group of students while the other students are working in their own recitation booths. Each booth had a writing shelf, one or more chairs, a set of lightweight, removable earphones, a two-way intercom speaker, and a light. In each booth there are four possible openings into which to plug the earphones. This allowed the teacher to select audio from one of the three tapes, a record on the phonograph, or a radio program depending on what she or he wanted the student to hear. A switch in each booth allowed the student to contact the teacher by turning on a light on the annunciator panel on the teacher's console (see Figure 8). The teacher, through the use of her headset at the console, could answer the student's question privately without disturbing anyone else. The use of the headset also allowed the teacher to listen in on what was going on in any of the booths without disturbing the student ("$40,000 Ford grant enables college to test new electronic teaching system," 1958; Sherman, 1958).

Figure 7. Classroom electron II. Photo by Petit's Studio. 1957

Figure 8. Classroom Electron II teacher's console complete with 3 tape recorders, record player, annunciator lights Switches for each of the 32 booths and teacher's headset.

Stoma (1957) reports that there was an individual measurement room in Our Lady of Wisdom Hall where the teachers posted records of each student's progress and of each class's achievements. The original plan was that this small room would be used as a research laboratory in which the teachers could study how a child actually learns. From what I could ascertain from conversations with former tape teachers and from Brentano's notes, the individual measurement room was never used for anything other than a place to post test results. It is likely that the primary reason for this is lack of development of the individual measurement room is that Brentano returned to Atchison, Kansas, at then end of August 1957, only months after Our Lady of Wisdom Hall opened.

1957 Summer Tape Workshop

Late in May of 1957, the Ford Foundation Fund for the Advancement of Education awarded Brentano $15,000 to conduct a six-week Tape Workshop in Our Lady of Wisdom Hall during the summer of 1957 (Fine, 1957). At the workshop, Brentano taught teachers how to implement her tape teaching methods in their own classrooms including how to write scripts, record tapes, and make worksheets. A total of 36 teachers, all members of Catholic religious communities, attended the workshop and made tapes in geography.

The Tape Institute at Mount St. Scholastica

In August 1957, Brentano returned to her home religious community of Mount St. Scholastica in Atchison, Kansas, to set up and run the Tape Institute. With more than $100,000 in grants from the Fund for the Advancement of Education over a three-year period, $23,000 from the Raskob Foundation for Catholic Activities, Inc., and with space and financial assistance from Mount St. Scholastica College, the Tape Institute was the center of Brentano's tape teaching innovation until the mid 1960s. The Tape Institute was responsible for creating more than twelve thousand tapes, scripts, and worksheets in all different subjects for all grades and distributing them to schools using Brentano's methods around the country. Most of these tapes were created by the teachers who attended the four summer tape workshops from 1958 to 1961. The Tape Institute was also responsible for coordinating the standardized testing done in tape schools and their counterpart non-tape schools to provide for statistical measures of the success of tape teaching.

By 1957 the following schools had adopted Brentano's individualized tape teaching methods:

- St. Scholastica Academy, Covington, LA: 5th through 8th grades
- Mater Dolorosa School, New Orleans, LA: 2nd grade, remedial reading
- Cathedral School, Lafayette, LA: 8th grade
- De La Salle Normal School and Junior Novitiate of Brothers of the Christian Schools, Lafayette, LA: social studies and chemistry
- Our Lady of Fatima School, Lafayette, LA: 6th grade
- Immaculate Conception School, Grand Prairie, TX: 4th grade, reading clinic
- Incarnate Word School, San Antonio, TX: 1st grade
- St. Joseph Cathedral School, St. Joseph, MO: 3rd and 6th grades

In 1958 there were 45 rooms in 16 schools using Brentano's tape teaching methods and by 1960 there were electronic classrooms in 80 schools (Keating, 1961, p. 20).

The Benefits of Tape Teaching

According to Brentano (1962, p. 369), there were four main benefits for students taught using individualized tape teaching. The first benefit was that tape teaching fits student's needs because the students listened to tapes especially made for their ability level. If a student needed special attention, then the teacher provided that while the rest of the class listened to tapes.

A second benefit was that tape teaching presented superior instruction since it was the goal of the teacher making the tape "to present the best material in the best way, so that the pupils who learn it will be equipped to live successfully in their world" (Knoedel, 1958). Tapes were not merely to repeat a textbook, but were to be creative, interesting, up-to-date works of art worthy of keeping and using again and for sharing with other teachers.

The third benefit of tape teaching was that students learned to concentrate better. According to Brentano, one reason for improved concentration is that the use of earphones created a feeling of a more personal contract with the teacher. “The hearing of a lesson on earphones is a much more intimate experience than hearing a tape played aloud. With this information going into the student's ears, and his eyes occupied with the worksheet, the attention is truly phenomenal” (personal notes of Brentano). Directions were given at the beginning of the tape. Since the tape did not repeat directions, students soon learned that if they missed the directions, they were out of luck since the teacher would be busy instructing another group and could not be interrupted. Throughout the tape, the student had to listen carefully in order to answer questions on the worksheet. At the end of the tape, answers to the worksheet were given and the student had to continue to pay careful attention to make sure s/he graded the worksheet properly.

The fourth benefit Brentano (1962, p. 369) listed for tape teaching is that it allowed the student to have more personal contact with the teacher. A former tape student told me that when she listened to a tape, she felt like the teacher was talking directly to her. Brentano claimed that tape teaching multiplied a teacher's voice and personality since she or he was really teaching four classes at a time–not just one. This allowed teachers “*more* time for discussion, *more* time for questions, *more* time for individual help” (emphasis original) (S. Ross & Kiester, 1958). Brentano strongly believed that tapes were not meant to replace a teacher, but were meant to supplement her by multiplying her presence in the classroom (M. T. Brentano, O.S.B., 1959; Keating, 1961; “Tape-recorders, books team up in first U. S. ‘Electronic Classroom’,” 1954; “What is a tape-teaching workshop?,” unknown).

Tape teaching often produced impressive test results. For instance, of the 100 elementary students at St. Scholastica Academy who were taught using Brentano's tape teaching methods during the 1956-57 school year, only one student failed to average the ten-month expected gain on the Metropolitan Test. “Twenty-five averaged a gain between one and two years; fifty-five averaged a gain between two and three years; eighteen a gain between three and four years, while one surpassed the equivalent of four years’ gain as measured by standard norms” (Laube, 1958, p. 13).

Some Problems and Challenges of Tape Teaching

As with all innovations in educational technology, tape teaching had its share of challenges and problems. In this section I briefly describe many of these challenges. One problem with implementing tape teaching was the cost of setting up an electronic classroom, the ongoing cost of maintaining it, and the cost of paper for worksheets. In 1958, Brentano estimated that a school could equip a classroom for tape teaching for $3000 (B. Ross & Ross, 1959). If the funds were available, a major problem was finding an electrician who could build and wire the specialized console since these were not available commercially. Tape teachers often shared with me that equipment did not work properly, i.e., tape recorders broke frequently, students couldn't hear with their earphones, headsets picked up radio programs rather than the tapes, etc. The quality of the recordings often made it hard to hear and understand a lesson.

Although tape teaching was supposed to give the teacher more time, tape teachers in the first years of the innovation found this to be anything but true. Since there were no scripts, tapes, or worksheets, the classroom teacher had to do all this herself/himself besides the usual classroom responsibilities. To research and write the kind of creative script that Brentano expected could take 20 or more hours. Another problem was that when a trained tape teacher left a school there was often no one trained to use tapes to replace her/him. The loss of the trained tape teacher often meant that tapes were no longer used or were not used as Brentano intended.

Brentano's intent was to have the Tape Institute create an entire tape curriculum for all elementary subjects, but this never came to pass. From what I can tell from my research, it seems that the Tape Institute never made an entire year's set of tapes for any subject for any grade. Most of the creative, artistic tapes produced by teachers for the Tape Institute were not correlated to specific textbooks. Teachers using tapes obtained from the Tape Institute had to figure out where in their own curriculum to use a tape or set of tapes. For instance, tapes that a teacher created for her/his fifth grade social studies class in Kansas may not fit with a similar class in Kentucky. Tapes also became outdated rapidly and required a teacher to update and re-record a new tape.

Since tape teaching was first implemented in Catholic schools, the press and others raised questions as to whether tape teaching could be as effective in public schools as it was in Catholic schools. An article in *The New York Times* (Fine, 1957, p. 47) asked, “Can this program operate as effectively in a typical public school, with large classes and overworked teachers?” Another problem that kept tape teaching from becoming more widespread in public schools was the Catholic content of many tapes. Most of the participants at the summer tape workshops were members of Catholic religious communities who taught in Catholic schools. As they would when teaching in their own classroom, the scripts they wrote contained numerous references to things Catholic although these were not scripts for religion class tapes. For instance, a script for a tape for first grade science began with, “Today, boys and girls, we are going to talk about this big, wide, wonderful world that God made for us.” The Catholic content of tapes was problematic when Brentano sold the tapes.

Brentano had little assistance in running the Tape Institute. It seems that she had someone available to multilith the worksheets and at times had part time secretarial help. From several letters written to Brentano from tape teachers, it seems that she sometimes had a hard time getting the correct tapes, scripts, and worksheets mailed to teachers in a timely manner.

In some ways Brentano may have been counter-productive in carrying on her own tape teaching innovation. For instance, her attitude was that all tapes were always unfinished. This attitude meant that Brentano was always in the process of revising and updating tapes. Brentano was not a practical, detail person, but a dreamer and a visionary. Once she had experimented with tape teaching and saw that it could be successful, Brentano moved on to explore her other creative ideas. As early as 1958, she started working on a Thinking Curriculum that used audio tapes and worksheets to teach thinking skills to children in elementary school. The Thinking Curriculum grew to involve the study of the importance of color in teaching and how to teach logic to elementary school children.

The End of Tape Teaching

With the increasing availability and popularity of video technologies in education and computer-aided instruction plus Brentano's shift to other interests, tape teaching soon became history. By 1962, there were no longer articles in newspapers or magazines about her tape teaching methods and by the middle 1960s, there was very little correspondence to Brentano regarding tape teaching. In 1970 Brentano entered into a contract with Scott Scientific, Inc. of Fort Collins, Colorado, to sell them the tapes, scripts, worksheets, reel-to-reel tape recorders, and other equipment with the hope that they could successfully market them. Despite the best efforts of Scott Scientific, including removing the references to God and things Catholic, re-voicing the tapes, copying them onto cassettes, and creating ditto masters of the worksheets, by 1971 Scott was no longer able to sell any of her tapes and Brentano’s tapes were eventually returned to her (A. Spring, personal communication, April 29, 2000).

Importance of This Research for the Field of Educational Technology

My research provides several interesting results for the field of educational technology. Due to space considerations, I discuss two of these in this paper. Besides making known an overlooked innovation in the field, my research provides a comprehensive look at an innovation in educational technology from its initial idea to its conclusion. I have extensive documents from Brentano including personal correspondence and even some reel-to-reel tapes that she made describing tape teaching and its history. Interviews with the first two tape teachers from St. Scholastica Academy, with several tape teachers involved during the height of tape teaching, and with some who used tapes during its waning years of use provide a fascinating look at the life cycle of an innovation. Personal communication with friends and associates of Brentano during the tape teaching years supply a wealth of knowledge and insights about what it was like for Brentano as an innovator in educational technology during the 1950s and 1960s. My dissertation, *Sister Mary Theresa Brentano, O.S.B.: Innovator in the Use of Magnetic Audio Tapes–An Overlooked Story in the History of Educational Technology* (Herndon, O.S.B., 2002 (anticipated)), provides a more thorough documentation of Brentano's innovation than is possible here.

The second implication of my research concerns why official histories of educational technology have overlooked Brentano's individualized tape teaching innovation. I believe there are several possible reasons for this oversight. Brentano's work was featured in more than thirty newspaper and magazine articles including *The New York Times* (Fine, 1957) and *Newsweek* (“Electronic classrooms,” 1957). The United States Information Agency (“USIA television service films electronic classroom,” 1959) produced a five-minute movie clip illustrating Brentano's tape teaching innovation. Upon her death, *The New York Times* (“Nun Who Pioneered the Use of Electronic Teaching Dies,” 1987) printed her obituary. One might guess that her place in the history of educational technology was assured. However, the popular press is not usually a place where academics look when writing the history of the field. For instance, De Vaney and Butler in “Voices of the Founders: Early Discourses in Educational Technology” (1996) used information from audiovisual textbooks and oral history audiotapes from the Archives of the Department of Audio-Visual Instruction. Brentano did not write a textbook about individualized tape teaching and the reel-to-reel oral tapes that Brentano herself made have been stored in the Mount St. Scholastica Archives unknown to anyone at all until this research.

The data that I have does not suggest that Brentano belonged to any professional organizations. One can only guess that Brentano may have believed that she did not have time or that she had no need for any type of professional affiliation. She did speak at many regional professional meetings and also two national conferences: the Catholic Audio-Visual Association Conference in 1954 and the Department of Audiovisual Instruction Convention in 1962. The only professional publication of her work is the text of her presentation from the latter convention published in *Audiovisual Instruction* (S. M. T. Brentano, O.S.B., 1962). One might guess that women religious were not permitted or encouraged to hold membership in professional organizations or to publish scholarly papers during the 1950s and early 1960s, but that was not so at Mount St. Scholastica. During this time period, several sisters were actively involved in professional organizations and in publishing scholarly research.[5]

Other reasons could also have contributed to Brentano's work being overlooked in official histories of the field of educational technology. Very little is written in any book regarding the use of audio tapes in the classroom, including Saettler's (1990) definitive history of the field, *The Evolution of American Educational Technology*. Brentano's original work with audio tape teaching was not based at a major research university, but at a small Catholic K-12 school. When she did move her base of operation to be associated with a college, it was to Mount St. Scholastica College, a very small Catholic women’s college in Atchison, Kansas. Although this does not outwardly appear to be a concern to Brentano, this move was not helpful in making her work known in academic circles. De Vaney and Butler (1996) state that, “Historically, although women in audiovisual education played major roles, they were often overlooked and/or assigned minor ones” (p. 39). One can speculate that the fact that Brentano was a woman and was a member of a Catholic monastery were also reasons in their own way for her being overlooked in official histories of the field.

Conclusion

This paper presented an overview of Sister Mary Theresa Brentano's innovation in educational technology–the use of magnetic audio tapes to provide individualized instruction to children in K-12 schools. I described Our Lady of Wisdom Hall at St. Scholastica Academy, Covington, Louisiana, the first school designed and built for electronic teaching with its two different types of Classroom Electron. Benefits of tape teaching were recounted along with some challenges and problems involved with the innovation. Lastly, I presented two contributions this research contributes to the field of educational technology: a complete history of an innovation in educational technology from its beginning to its end and some reasons how an innovation such as this can be overlooked in the official histories of the field.

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Build It and They Will Stay: A Research-Based Model for Creating Community in Web-based Learning Environments

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Abstract

The purpose of this study was to explore best practices for community building in Web-based learning environments. The study took place in two Web-based courses at two universities. An embedded case study design was used, and multiple sources of evidence (e.g., chat and bulletin board transcripts, interviews, and surveys) were gathered to inform the results. Overall, participants in both courses indicated some sense of community, albeit limited in scope (i.e., the learners indicated a stronger connection with their team members than with the larger class group). While more research is needed, our study indicates that enabling and encouraging the use of these strategies and techniques may contribute to the long-term viability and use of WBI in institutions of higher education.

Introduction

The use of electronic technologies for the delivery of instruction has grown at an exponential rate over the last five years. Institutions of higher education, corporations and K-12 environments continue to seek ways to use on-line tools to deliver instruction. Concurrently, the technological infrastructure is expanding in terms of its capabilities and power (Daniel, 1998; Katz, 1999), increasing learner access to the technologies needed to acquire and share information with other participants. This convergence in interest by educators and learners in learning via distance technologies has enabled an exponential increase in the quantity of distance courses and programs across disciplines (e.g., art, history, information systems, education, science) and contexts (Otchet, 1998).

While the increased interest and need is an exciting development, several challenges associated with the successful implementation of Web-based instruction (WBI) remain unresolved, including retention and high dropout rates (see Barley, 1999; and Hill, in press, for an overview of several issues). Retention has historically presented challenges for distance educators. According to Moore & Kearsley (1996), dropout rates have ranged from 30 - 50%. While this figure is inclusive of a variety of distance learning technologies (video, print, etc.) and the authors point out that the dropout rate would now be at the lower end, 30% is still a considerable percentage to lose in a learning experience. WBI, with its high demands psychologically and technically, makes this challenge even more significant.

Several factors may contribute to retention challenges in distance education. Factors mentioned in the literature include: lack of prior experience with distance learning, external demands, and conflicts with motivation demands (external vs. internal) (see, for example, Carr, 2000). Another explanation for high dropout rates and dissatisfaction with distance delivered courses may relate to a lack of a perception of community in courses that are not face-to-face. Students may feel like they are isolated, creating an experience of lack of presence from others involved in the course.

Perception of a community may assist learners with feeling connected or belonging (Halaby, 2000; Joyce & Weil, 1996). Research in on-line environments indicates that community building can occur in distance delivered courses (Hill, 1999a; Palloff & Pratt, 1999), much like community building can occur in virtual teams in the business sector (Lave & Wenger, 1991; Raven, 1999). Given that a sense of a community has been demonstrated to contribute to group performance within a corporate context (Lave & Wenger, 1991), it may prove to be a benefit in a learning context. Discovering the best strategies and techniques for community building may lead to enhanced course outcomes (e.g., retention, satisfaction, learning outcomes) by participants in WBI.

Purpose

The purpose of this study was to explore best practices for community building in WBI. In doing so, the study sought to examine specific strategies and techniques designed to facilitate the establishment of an on-line community. The study was guided by the following general research question:

What are the best techniques/strategies to enable community building in WBI?

This question was addressed through a number of sub-questions, two of which will be focused upon in this paper:

- What can we do, as designers of, and instructors in, a WBLE to assist the learner in the effective building of community while learning in a Web-based environment?

- What strategies can learners use to assist themselves (individually and with each other) in community building while engaged in learning in Web-based environments?

Significance of the Study

While considerable research has been conducted in the general area of distance learning, research specific to Web-based environments for learning has only recently been published (see, for example, Dehoney & Reeves, 1999; Khan, 1997; Hill, 1997a; Hill, 1999a; Owston, 1997; Pritchard, 1998), and most is being presented at a theoretical rather than an empirical level. As the Web and Internet-based technologies (e.g., bulletin boards, e-mail, CUSeeMe, streaming video, instant messaging) continue to grow in popularity and use in higher education, we felt that institutions would benefit greatly from investigation of best practices related to WBI, in our case, specifically examining best practices for community building.

Interest in building community is certainly not new, nor is it something isolated to study in the context of higher education. Lave and Wenger (1991) have spent considerable time examining the issues related to forming community in a business and industry setting. Joyce and Weil (1996) called for the creation of a communities of professional educators within a school setting. Halaby (2000) brings the notion of belonging into the classroom setting, emphasizing a need to help students belong. More recently, Palloff and Pratt (2001) extended their work on community building within higher education settings, focusing on providing hints and tips for the online teacher.

Certainly, this work is useful and adds to our literature base. However, much of the work completed to date is primarily theoretical, and while based in experience, is not primarily driven by empirical research. Further, the current work does not define specific models for how to enable community-building in a Web-based environment -- both from the teacher and student perspective. We need data-driven strategies and models, presenting techniques on both sides of the desk, so that others can test the robustness of the models in a variety of environments.

Research Plan

Research Design

An embedded case study design was used for this study, involving the use of multiple cases, or embedded units, within a larger context. The unit of study in the case was the individual faculty member or student involved in the WBI implementation. Multiple sources of evidence were used to triangulate the data, thus addressing possible concerns with internal validity (Yin, 1994). This approach has been used by one of the researchers in previous research (Hill & Hannafin, 1997; Hill, 1997b), and has proven successful when looking to describe rich contexts, and for model development (Hill, 1999b).

Selection and Description of the Participants

Two groups of participants were engaged in this study. One consisted of a an instructor and students involved in the Master's level course Information Technology Infrastructures in a college of business at a university in a large metropolitan area. The other consisted of an instructor and Master's level students involved in the course Instructional Design in a college of education at a university in a rural area. The population included university instructors, instructional design experts and working professionals returning to school from various sectors of business and industry (e.g., information technology management, technical support, Web development) and education (K-12 and higher education).

The courses were selected for two primary reasons:

- Involvement in the courses was voluntary. Although for many students the courses were required for completion of the degrees, they decided when and how to take the course. Most students enter with a high level of interest and motivation.
- Learners begin the course with a variety of backgrounds, as well as differences in their technology experience. This variety is essential for examining strategies and techniques across potential students.

Two groups comprised the sample of this study:

- university faculty as subject matter experts to help inform the design, development, and implementation of the courses; and
- students enrolled in the courses during summer term.

WBI Development

Measures and Instrumentation

A combination of positivistic and interpretivist techniques were used in gathering evidence for the study. Various instruments were used to facilitate data collection for the study: surveys, interviews, observations, and content analysis of discussion transcripts. Positivistic techniques were used to generate individual difference measures for each case. Interpretivist techniques were used to monitor the use of community-building strategies and techniques.

Settings and Procedures

Implementation of the courses took place over a 7-8 week period during the summer of 2000. Data were collected in a variety of environments. Pilot testing with learners in the spring and data gathering with learners in the summer took place in the environment in which the WBI was used, including campus computer labs and the learners' homes/places of employment (depending on where they have access to the Web). A combination of questionnaires, observations, interviews, and content analysis of transcripts from on-line discussions were used to gather data from students. The facilities and necessary equipment for data gathering were fully established at each institution.

Analysis

To the extent possible, the collection, organization, and initial analysis of data occurred concurrently. Previous research indicates that this assists with indicating gaps in data as they are gathered and allow for adaptations in the process (e.g., need for additional information) (Glaser & Strauss, 1967; Hert, 1992; Hill & Hannafin, 1997). One "gap" that did occur related to the number of participants. We did experience a reduction in participants in both courses, with the final number of participants being 21 in the Information Technology Infrastructures course and 22 participants in the Instructional Design course.

In-depth data analysis took place throughout the academic year following the offering of the courses. One level of in-depth analysis involved reading through and coding the transcripts from the online chat and bulletin board discussions. As the researchers read the data, pre-established codes were used to mark-up the data (Ericsson & Simon, 1984; Hill & Hannafin, 1997). Additional codes were established as themes and patterns not readily applicable to the established categories emerged.

Another level of in-depth analysis involved chunking sections of the data related to specific research questions according to pre-established strategies and techniques for community building (Hill, 1999b). Pattern matching was used to inform the generation of an overall list of strategies and techniques -- instructor and student -- for community building in WBI, enabling the creation of a theoretical model for community-building in WBI. These coding and analysis techniques have been documented in the literature (Bogdan & Biklen, 1992; Krathwohl, 1998; Yin, 1994) and were used by the researchers in previous studies (Hill, 1997b; Hill & Hannafin, 1997).

Data Presentation

The content of each student’s and instructor’s posting was analyzed to determine the number and type of constructs was examined. Thirteen constructs in participants’ posting were identified: active interaction, socially constructed meaning, expressions of support and encouragement, collaborative learning, sharing information, acknowledgement of others, chitchat, teacher initiative, student initiative, teacher response, student response, student evaluation, and teacher evaluation.

To help inform the results, the data were first divided into two main categories: infrastructure strategies and interaction strategies. Codes and definitions for strategies included in these categories are displayed in Table 1.

Codes	Constructs	Definition
AI	Active Interaction	Involving both course content and personal communication; purposeful, engaged, energetic
SCM	Socially Constructed Meaning	Agreement or questioning with the intent to achieve agreement on issues of meaning
ESE	Expressions of Support and Encouragement	Encouraging comments to their classmates. Exchanged between students.
CL	Collaborative Learning	Sharing ideas and knowledge among students. Comments directed primarily student to student rather than student to instructor
SI	Sharing Information/Resources	Among students (resources = container) Integration of people, resources
ACK	Acknowledgement of others	Noting presence of person
CC	Chit Chat	Social interactions not related to class

Table 1. Codes for infrastructure strategies

We also divided the interaction strategies categories (data) into two other categories: instructor strategies and student strategies. Codes and definitions for strategies included in these categories are displayed in Tables 2 and 3.

Codes	Constructs	Definition
TI	Teacher Initiative	Asking question to lead and facilitate the discussion
TR	Teacher Response	Answering questions to respond to student
TE	Teacher Evaluation	Teacher evaluation about student response

Table 2. Codes for interaction strategies – instructor strategies

Codes	Constructs	Definition
TI	Teacher Initiative	Asking question to lead and facilitate the discussion
SI	Student Initiative	Asking question to negotiate or clarify the source and extent of disagreement
TR	Teacher Response	Answering questions to respond to student
SR	Student Response	Answering questions to respond to teacher
SE	Student Evaluation	Willingness to critically evaluate work of others
TE	Teacher Evaluation	Teacher evaluation about student response

Table 3. Codes for interaction strategies – student strategies

We also analyzed the data from a qualitative perspective, seeking to understand how events occurred overtime. Figures 1 and 2 exemplify the graphs we made to help inform this level of analysis.

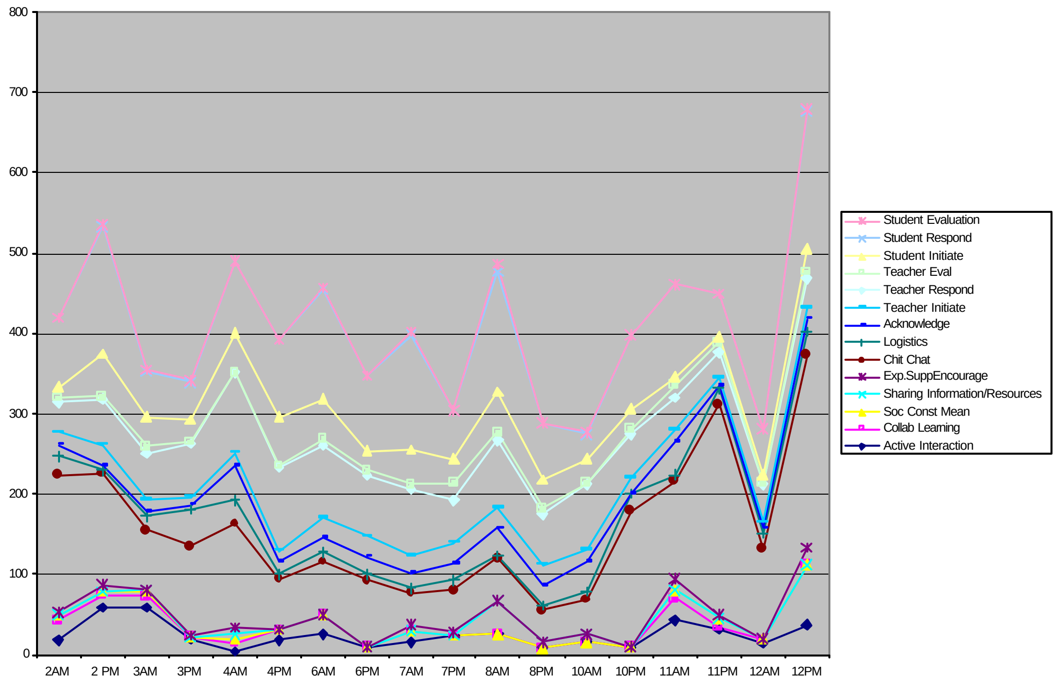

Figure 1. Coding of all chat sesions for the Information Infrastructures course

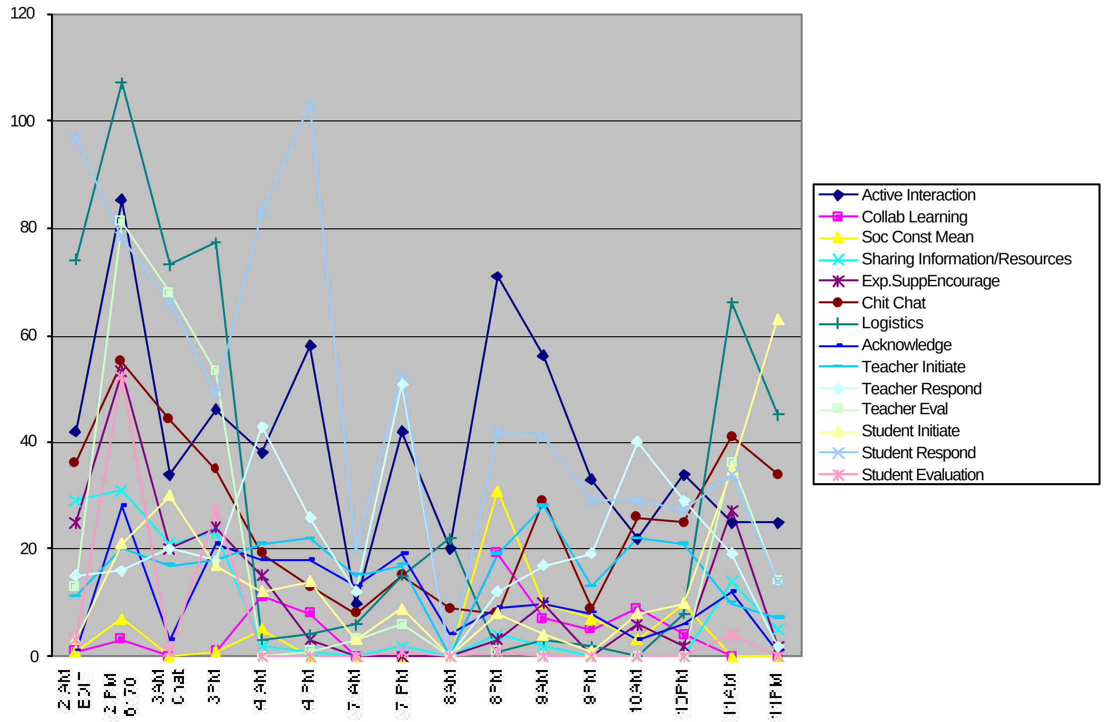

Figure 2. Coding of all chat sesions for the Instructional Design course

After coding of the transcripts was complete and initial patterns were emerging, the researchers then looked at other data sources as points of triangulation of the findings. Focus group interview notes were reviewed; end of term surveys were analyzed. Trends in these data were then compared to the trends and patterns established from the discussion transcripts. Strategies and techniques were adjusted as needed based on the data.

Findings and Results

Analysis of the data was an intensive task, cognitively and logistically. Many hours were spent by the researchers, individually and as a team, reviewing and refining our findings. The results of our efforts are presented below, organized according to our research questions.

What can we do, as designers of, and instructors in, a WBLE to assist the learner in the effective building of community while learning in a Web-based environment?

Based on feedback from the learners during implementation, as well as expert review of the course, there are several things that designers and instructors can do during the design, development and implementation stages to help with community building in WBI.

One strategy that proved very effective was ensuring that learners have sufficient opportunities to interact with each other as well as with the instructor. Our research indicates that learners want a variety of ways to interact with each other. Learners in the Information Infrastructures course and the Instructional Design course indicated that all of the communication technologies (e.g., chat, bulletin boards, email, phone) were working well and were important for facilitating interactions.

Another strategy used in the Instructional Design course that proved effective was the use of CSM messages. CSM messages indicated to learners what they Could be doing, what they Should be doing, and what they Must be doing. These messages were sent out by the instructor once or twice a week to remind learners of tasks for the week. During the mid-term evaluation, learners indicated that the CSM messages were important not only for keeping them on track, but also for letting them know that the instructor was there.

Yet another strategy that proved effective for community building was the use of teams for completing work. In the Information Infrastructures course, teams of 2-4 worked together; in the Instructional Design course, teams of 2 worked together (i.e., Design Buddies). In both instances, the learners indicated that the team members contributed very positively to their sense of belonging and a sense of connection with others in the course.

There were also several strategies built into the structure of the Web sites to assist with community building. These included: access to multiple communication technologies, posting of announcements and "what's new" updates, and personal Web pages for each learner that included a picture and biographical information. All of these approaches appear to have contributed to the ability of a community to form as the learners interacted within, and used, the WBI environment for learning.

What strategies can learners use to assist themselves (individually and with each other) in community building while engaged in learning in Web-based environments?

Analysis of surveys, as well as transcripts from various interactions in the courses, indicate that several strategies were used by learners to assist themselves with community building and learning in a WBI environment. A strategy used by several learners was a daily visit to the Web site to check for new messages on the bulletin boards. While many learners indicated that this was frustrating ("takes too much time"), others stated that the frequent visits helped them with establishing a sense of belonging to the course.

Two other closely related community building strategies used by learners are encouragement and support. Evidence of this was seen throughout bulletin board postings, chat room interactions and e-mail messages between team members/Design Buddies as well as between WBI participants in general.

Several learners indicated that the experience was somewhat overwhelming. This comment related mainly to the number of messages learners had to read on bulletin boards, in chat sessions and in e-mail. One strategy mentioned by several learners was that of scanning; that is, reading for content not for detail, in order to keep the information exchange manageable.

What are the best techniques/strategies to enhance community building in WBI?

Overall, several strategies and techniques for community building in WBI emerged from the initial analysis. The strategies and techniques, compiled across those discussed in the research sub-questions, have been divided into two main areas: infrastructure and interactions (see Table 4).

Infrastructure Strategies	**Interaction Strategies**
Access to multiple communication technologies.	Read for content not for detail.
Posting of announcements and "what's new" updates.	Encourage and support fellow learners in their efforts.
Personal Web pages for each learner.	Use CSM messages to indicate to learners what they Could be doing, what they Should be doing, and what they Must be doing in terms of the course.
Learners have sufficient opportunities to interact with each other as well as with the instructor.	Use of teams for completing work in the course.
	A daily visit to the Web site to check for new messages on the bulletin boards.

Table 4. Strategies and techniques for community building in on-line environments.

Infrastructure strategies are the responsibility of the instructor. They create the environment that enables or inhibits the formation of community. Interaction strategies take place during the class, they involve actions from both the students and the instructor/facilitator.

We have also represented the strategies in terms of target audience, i.e., instructor or learner (see Table 5).

Instructor Strategies	**Learner Strategies**
Provide multiple opportunities for interaction.	Visit the course Web site daily (or every other day at a minimun).
Send out management related messages (e.g., CSMs) on a regular basis.	Provide encouragement and support.
Establish teams so that learners work together to complete tasks	Scan material posted on the Web site - do not read for detail.
Keep the Web site up-to-date and add in new information on a regular basis to keep things "fresh."	

Table 5. Instructor and Learner Strategies for community building in on-line environments.

Community Building: A Process-based Model

It would appear that some level of community building did occur in both the Information Infrastructures and the Instructional Design courses. Specifically, by looking at graphs of the interaction data (as recorded in the bulletin board and chat transcripts (see examples in Figures 1 and 2)), we see evidence that community was established over time and that there were certain points in the term where participants were "closer" in terms of a community than others.

The analysis completed to date has enabled the creation of the beginnings of a theoretical model for community building and its potential relationship to learning (see Figure 3). While the model is not complete, it does exemplify a significant step toward identification of strategies and techniques that can enable the creation of community in WBI.

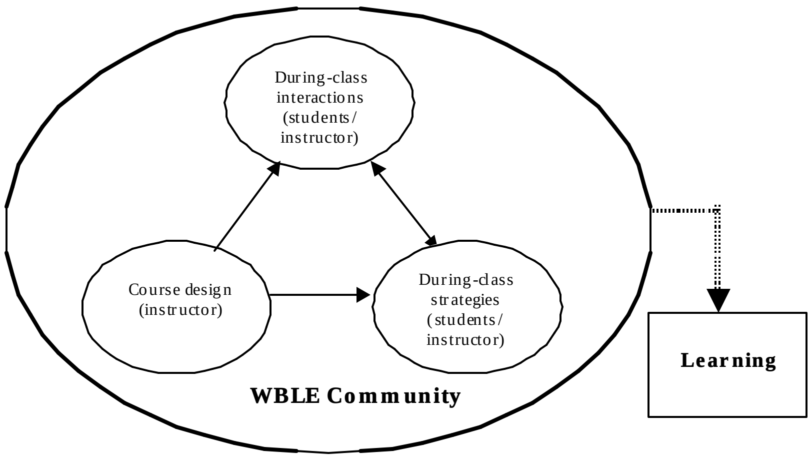

Figure 3. Creating Community for Learning

The model in Figure 3 illustrates how community building strategies may lead to community building activities that take place during a class, which leads to the existence of community. The existence of community is predicted to result to higher levels of learning. This learning can be measured through the coding of instances of socially constructed meaning, and collaborative learning.

As discussed earlier, in the design phase of a course, the instructor can implement a number of strategies that provide a basic infrastructure for community building. During the class, both instructor and students can use interaction strategies for community building. The two sets of strategies lead to interactions during the class, again by students and instructor, and these interactions lead to the emergence of a community.

Discussion & Suggested Next Steps

This study investigated strategies and techniques for community building in WBI. Overall, participants in both courses indicated some sense of community, albeit limited in scope (i.e., the learners indicated a stronger connection with their team members than with the larger class group). While more research is needed, our study indicates that enabling and encouraging the use of these strategies and techniques may contribute to the long-term viability and use of WBI in institutions of higher education.

As we continue work in this area, we are also beginning to consider different questions and issues to explore. One issue we offer as an area for additional study is that of adjustments to change. As compared to face to face classes, WBI courses place more demands on both instructor and students in terms of amount of time worked, and number of student-instructor and student-student interactions. As with regular face to face classes, it is better to wait with the evaluation of a WBI course until it has been taught at least twice. The first time around is typically a learning experience for the instructor and the learner; better to use this as a vehicle to determine what works and what doesn't, and then make additional judgments the second -- or third -- time around.

We also recognize the need for assisting others in the implementation of community building strategies in their own WBI experiences. Models and tools to assist with this effort would go a long way toward helping others interesting in building community in their own WBI. We are currently developing a model for community building in WBLEs, and encourage others to also explore this area.

Conclusion

By delivering engaging and meaningful instruction in WBI environments, the university can increase its visibility and viability in the 21st century educational arena. Further, results from this study can be used to guide and facilitate the design, development, and implementation of WBI to increase interaction and engagement. This, in turn, can potentially lead to higher retention (our experience: 94%) and satisfaction (our experience: high) in on-line courses at institutions of higher education.

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Learning in Action: The Professional Preparation of Instructional Designers

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Abstract

This was a case study analysis of instructional designers and their preparation for professional practice. Seven instructional designers were selected to participate in this study based on the following criteria: employment at a company developing instructional materials for external clients, three to five years experience, and attendance at a graduate program of instructional design or technology.

Each participant was interviewed on two occasions using a semi-structured interview format. Case studies were presented on the analysis of the interviews and quotes were used to accurately express the perceptions and feelings of each participant. The cross-case analysis identified major themes, which emerged from the interviews.

Individual differences as well as common perspectives on preparation and professional practice were noted between the participants. This study confirmed prior research into the preparation of instructional designers for professional practice. The theoretical body of knowledge as well as the practical knowledge and competencies used to solve problems in a variety of environments define this practice. This research identified three profiles of instructional design practice that correlate with the expert-novice continuum: Innovator, Traditionalist, and Practitioner. This study also identified instructional designers' perceptions of effective graduate preparation for instructional design. Recommendations for instructional technology programs and for future research are provided.

Background

<u>Instructional Design: Science and art.</u> A blank canvas and a variety of paintbrushes and pigments are merely tools; the paintbrushes form textures and the pigment color. Their potential to become a work of art lies in the artist's knowledge about materials and composition, intuition and creativity. Applied to the canvas, textures form layers that the artist explores and adapts into shapes and meanings until, like pieces of a puzzle, they fall into place and form a personal message. Instructional Design (ID) practice is also both science and art. Its blank canvas is an organization's need or learning opportunity and the potential for an effective solution. Just as the painter's tools fill a canvas with texture and color, a multitude of systematic models outline the ID process and methods adapted from a variety of disciplines are available to the designer. Their potential as tools for effective practice lie in the instructional designer's knowledge, creativity, intuition, and analytical skills. Applied to a design problem, the ID tools form layers that the instructional designer explores and adapts until, like pieces of a puzzle, they fall into place and form an innovative solution that meets target audience needs.

Instructional design is a young discipline commonly defined by its scholars as a systematic and reflective problem-solving process used to analyze instructional and informational needs, identify solutions, and design and develop support for learners of any age, in any environment. ID borrows from a broad array of theories, research, and experience-based models in the fields of engineering, education, psychology, cognitive science and business, among others.

> *An instructional designer is like an engineer. Both plan their work based upon principles that have been successful in the past... Both try to design solutions that are not only functional but also attractive or appealing to the end user. Both the engineer and the instructional designer have established problem-solving procedures they use to guide them in making decisions about their designs (Smith & Ragan, 1999, p.2)*

Instructional design literature often equates the birth of ID with the onset of World War II when educational psychologists and educational technologists joined forces to meet the training needs of the military (Richey, 1993; Saettler, 1990). ID practice has since evolved to address organizations' needs in environments that range from K-12 to higher education, government and military training, to a variety of corporate settings found in business and industry. Instructional designers in K-12 or higher education environments are often placed in positions as educational technologists with the responsibilities that range from curriculum development to incorporation of new teaching and learning pedagogues. Military-based instructional designers may need to develop training materials for classroom and field training but must function within a well-established hierarchy and policies that dictate performance objectives and goals. Finally, instructional designers in corporate environments may contend with novel situations that vary from project to project. In internal training departments, this often includes development of in-house training or information support materials. In the case of consulting companies, materials are designed and developed with or for external clients.

The models used to describe the ID process can be traced back to the early 1960s with the introduction of the first visual model, *Instructional Systems* in 1961 (Banathy, 1968). Using flow-charts and descriptive text, this model presented the stages of instruction systems design as analysis of a system, solutions for the system's problems, and subsequent development of a new system. The *Instructional Systems* model emphasized analysis as an iterative process rather than a "linear-causal orientation of classical scientific thinking" (Banathy in Gagne, 1985, p.87)

The iterative nature ID practice remained a guiding factor in the numerous instructional design models that were created following the publication of Banathy's *Instructional Systems* model (Gustafson, 1981; Hannafin, 1986; Reigeluth & Nelson, 1997; Richey, 1993; Rowland, 1993; Seels, 1989). Each model was an effort to reflect the evolution of the field and advances in learning theory, cognitive science, and system theory. Several adaptations were introduced to the ID process, including additions that helped streamline the process such as rapid prototyping and strategies such as performance support that helped create materials appropriate to today's work environments. Technologies available for learning materials changed rapidly as did the opportunities for mass distribution to learning audiences via computer technologies and the World Wide Web. In spite of these adaptations, the conceptual framework of instructional systems design models remained virtually unchanged since their development in the 1970s. They continued to emphasize the components that defined the ID process; analysis, design, development, and evaluation (Dick & Carey, 1996; Gagne, Briggs, & Wager, 1988; Richey, 1986; Smith & Ragan, 1993).

<u>Research in ID Preparation and Practice.</u> During the years that followed the introduction of the first systems design models for instruction, higher education institutions began offering graduate programs in instructional technology and included instructional design as a part of their core curriculum. Many of these programs evolved from audio-visual or communications programs. The preparation of instructional designers was based on prescriptive theories that focus on what designers *should* do when designing instructional in actual practice. ID courses treated the ID process as a procedural, linear model used to solve design problems. This approach led the instructional designer through a process of solution identification, moving progressively from the problem towards the desired goal using a top down, procedural process (Ertmer & Cennamo, 1995).

As in any emergent profession, each environment of practice has helped shape and define ID practice and, ideally, each environment of practice should influence the professional preparation of its practitioners. This was the focal area of research into professional preparation in the 1980s and 1990s. We learned how expert instructional designers identify problems and interpret instructional needs (Rowland, 1991, 1992; Perez, 1995, Perez and Emery, 1995). We explored the dynamics of professional practice from designers who were from a variety of educational backgrounds (Pitlik, 1995; Atchison, 1996) and we learned about the diverse nature of ID practice (ASTD, 1983; IBSTPI, 1986, 2000; Atchison, 1996).

The competencies that were identified covered a full range of procedural, problem-solving, collaborative, management and technology skills and the dynamics of professional practice pointed to a need for increased focus on the transfer of theory into practice. Researchers recommended that graduate instructional technology (IT) programs provide learning experiences reflective of the complex environments found in actual professional ID practice (Quinn, 1995; Tripp, 1994). Their recommendations promoted such methods as real-world projects, case studies, and apprenticeship models (Rowland, 1992; Roland, Parra, Basnet, 1994; Perez, 1995; Quinn, 1994). ID instructors implementing these strategies began to explore coaching methods that would encourage their students to consider multiple perspectives and reflect on their design decisions (Tripp, 1991, 1994; Ertmer & Cennamo, 1995). Many of the strategies were adopted from other design fields, such as architecture and engineering, which had successfully implemented open-ended learning experiences that encouraged reflective practice. Their interest was to incorporate some of the skills that research into professional practice and cognitive learning theory uncovered such as collaboration, problem-solving, management, and effective, yet flexible implementation of the ID process (Rowland et al., 1994).

With instructional technology programs across the country exploring ways to adapt their core curriculum in this way, questions about the relationship between graduate IT programs and professional practice emerged. What aspects of the graduate IT education experience did instructional designers find effective in preparing them for professional practice? Were they able to transfer the core knowledge, strategies and methods they learned to actual practice? Or, did they struggle to draw connections between their graduate education and professional practice? The purpose of this paper is to present a comparative case study that explored the complex relationship between preparation and practice through an examination of instructional designers and their perceptions of academic preparation. Seven instructional designers in ID consulting firms provided insight into their academic and professional experiences and their recommendations for graduate IT programs. Through interviews, observations, and product reviews, this study attempted to examine:

- What instructional designers in this environment actually do,
- What parts of their academic training (content and methods) best prepared them for this, and
- What gaps existed in their professional preparation, as demonstrated by the knowledge and skills they had to develop in actual practice.

Method

The exploratory nature of an inquiry into characteristics of instructional design practice and academic preparation, suggested an interpretive case study approach using naturalistic, qualitative methods. An interpretive case study employs naturalistic inquiry to inductively understand participants' experiences in the environments in which they practice. Thick, rich descriptions illustrate complexities and enable an in-depth exploration of phenomena (Lincoln and Guba, 1985; Patton, 1990). Broad topics initiated the inquiry, which were later refined to themes and explicit questions that led to a tentative hypothesis and eventual conclusion (Marshall & Rossman, 1989).

The diversity of practice environments presents a continuing need to interpret what designers do in various domains so that we may effectively prepare novice instructional designers for successful practice. In this study, I focused on one specific domain of practice, companies that produce ID products for external clients. This enabled me to gain an in-depth understanding of the effectiveness of academic preparation and the dynamics of professional practice in this particular setting. Purposive sampling identified the seven academically trained instructional designers from four Instructional Technology graduate programs. The participants had been working in this capacity for no less than three and no more than five years. This time span ensured that the designers had sufficient professional experience to reflect on actual practice, yet could still recall the details of their academic preparation.

In naturalistic inquiry, the design of the study is emergent. Data collection and analysis were conducted simultaneously. In-depth interviews followed a semi-structured format in the natural work setting of the instructional designers. Questions emerged to elicit the designers' approach to ID practice. The participants were encouraged to speak freely about any topic related to academic preparation and ID practice. They described adaptations they had made to the methods and strategies they learned in graduate school and what they felt best prepared them for actual practice. A tour of each participant's work environment, a review of recently completed projects, and company literature ensured a holistic understanding of the phenomenon under study. The participants received a copy of their interview transcripts and participated in a follow-up telephone interview that confirmed the accuracy of the transcripts and my interpretations of their experiences. The telephone interview also took the form of a semi-structured format, focusing on questions that emerged from a preliminary analysis of the initial interview responses.

All interviews and supporting materials were coded based on the Miles and Huberman procedure, beginning with an initial coding scheme that was subsequently developed for each participant after the first interview. The constant comparative method of Glaser and Strauss (1967) as interpreted for naturalistic inquiry by Lincoln and Guba (1985) guided analysis of the data; social phenomena were compared across categories as they were recorded and classified. This description, interpretive commentary and direct quotes from the interviews conveyed the meaning of everyday life at the site and ground the categories with full descriptions of the natural sequence of events prior to and during actual practice.

Results and Discussion

A cross-case analysis is presented according to the emergence of themes within three major categories, strength of academic preparation, professional practice, and skills learned on the job, and the participants' response to the final question, "What recommendations do you have for graduate IT programs?

Strength of Academic Preparation. Academic programs that prepare instructional designers are most likely to be in a School of Education (Heinich, 1995). Of the four instructional technology graduate programs represented in this study, one constituted a separate college and three were programs housed within schools of education. One might therefore assume that the majority of students entering these programs would come from K-12 education backgrounds. However, students enrolling in IT graduate programs come from a variety of disciplines, and many enter graduate school soon after they complete their undergraduate degrees. This was the case for the five of the seven participants in this study who had earned degrees in English, environmental science, and communications. The four participants who spoke about their decision to attend graduate school soon after earning their bachelor's degrees felt that there were limited employment opportunities for their major. As Casey explained, "Being an English major and all, I don't think that left me a lot of (career) options," and she didn't feel ready to enter the workforce; "I wasn't sure what I wanted to do with my life so I went to graduate school."

Instructional design is an emergent profession whose members continue to define its practice according to the type of environment and the perceptions of those who have a stake in the instructional outcome (Ritchie, 1999). As a result, students entering graduate IT programs often are unable to specify precisely what job they will hold when they graduate. All of the participants knew that they would be integrating technology with instruction in their work, but thought that their primary responsibility would be the development of instructional multimedia products. As Anne noted, "My expectation was that it was going to be more technical than it was. I thought I would be more of a developer." Instead, these individuals found that their work focused more directly on the design of instruction. Additionally, all but one participant thought they would be designing and developing educational software applications for children. The exception, Anne, chose her graduate program because of her experience working for a distance education program in a university medical school.

Foundations in Specialized Knowledge. A professional education begins with an introduction to the profession's "specialized body of knowledge," those explanatory and applied theories and doctrines "that must inform and guide and provide a repertoire for reflection" (p. 34, Harris, 1993) in practice. Although Schon (1983) argued that professional expertise results from practical knowledge, the development of the tacit, higher level problem solving skills used in actual practice, he recognized that this specialized knowledge within each profession has its place. This "technical knowledge," serves as the framework upon which professionals begin to build the knowledge base that guides the experiences leading to professional expertise. In the field of instructional technology, this foundation for professional practice commonly falls into three categories: instructional design, learning theory, and technology. These are the predominant topics described by the participants in this study as forming the foundation for their professional practice:

> Grasping at the fundamentals... I think that's basic. Just like it is for the architect who needs basic math, you have to know that to go to the higher levels. They are key foundational pieces for my practice and, depending on how the design builds on that is whether or not the instruction is effective. (Laura)

Several participants also considered research methods a part of their foundation because it enabled them to understand the research literature and theoretical underpinnings of the concepts they explored in their other classes. For some, the research methods course also enabled them with skills to interpret research on current trends and topics relevant to products they designed.

The participants also noted two areas that project management and human relations should be included in the foundations courses for ID practice. They recognized that these skills develop in actual practice, but felt strongly that an exposure to the management, communication and interpersonal skills that they use on a daily basis would give instructional designers a foundation that they could build upon. Laura was the only participant who attended a project management or human relations course; she found that the case scenarios her instructors used provided her with a springboard for identifying solutions to similar challenges. She did not begin to comprehend the complexity of management and conflict resolution until she applied these skills in actual situations.

Transitions to practice. Some participants found that traditional classroom activities such as presentations, guided discussions, and reaction or research papers were appropriate for their explorations of the history of the field or the learning theories that form the foundation of design. Three of the participants, for instance, expressed an appreciation toward their instructor's dynamic lectures and the breadth of materials they explored in their learning theory courses. Although they continue to study and review learning theories as the need arises, this foundation enabled them to help the client understand and determine "the pedagogical approach" that is most appropriate for the target audience. Other participants did not invest in these courses because they could not see the relevance of the topics they were studying to what they envisioned as professional practice at the time.

The same participants who appreciated the traditional classroom environment for their exploration of theories agreed with their counterparts, however, that applied skills and knowledge should directly reflect actual practice. "*The real-world projects and the combination of ID with technology were the real strength of our program* (Sharon). The participants identified four instructional methods that they considered appropriate for developing their skills and knowledge for professional practice: discussions with expert instructional designers and business owners, explorations of real-world examples, real-world projects, and case-studies.

Those who had the opportunity to participate in real-world activities expressed an appreciation towards their instructors for coaching them throughout their projects and helping them reflect on their options and evaluate their decisions. The instructor-coaches guided the learners in a review and reflection on their decisions and the resulting outcomes. In doing so, learners internalize the design process, which leads to a holistic awareness of the interdependence between its component parts (Schon, 1987). If an instructional designer understands the purpose and interrelationship of the component parts of the ID process, he or she understands how to adapt its component parts as needed to obtain acceptable results. This leads to effective design and development in almost any situation (Jonassen, 1994).

One of the participants, Casey, for instance, described her "real-world" ID experience in an elective ID class facilitated by an instructor who coached the students through each stage of the Dick & Carey model as they created instructional products. Coupled with the instructor's guided discussions, her review of papers they submitted on related topics, and her one-on-one feedback, Casey began to grasp the purpose of the stages of the ID model and recognized the value of the ID process. "If you look at (the ID process) in pieces, each of the pieces is adapted in some way."

From Preparation to Practice. An analysis of the individual differences and specific issues connecting perceptions of academic preparation to professional practice emerged as three profiles of ID practice: Innovator, Traditionalist, and Practitioner. Within each of the three categories, the participants reflected similar types of expertise. The Innovators reflect the skills and characteristics used to describe the successful ID professional. They are "Innovators" because they exhibited a common characteristic; an inner confidence that enables them to think "outside-the box" and motivates them take the creative risks that lead to innovative solutions. The single "Traditionalist" follows a unique path towards expertise, a traditional model of apprenticeship. The "Practitioners" exhibit some of the skills exhibited by the Innovator to a lesser degree, but tend to accept instructional problems from clients and their requested solutions at face value.

Many of the different characteristics that describe the expert to novice continuum are reminiscent of the characteristics proposed for Innovator, Traditionalist, and Practitioner. Towards one end of the continuum, the Innovator exhibited characteristics of the expert, who is able to solve problems in new situations by mentally organizing previously acquired knowledge and applying it in a meaningful way (Gage & Berliner, 1984). According to the Dreyfus model of skill acquisition, the Innovator is similar to the fifth and final level on the continuum between novice and expert, appearing flexible and easily adapting to the demands of new situations (Dreyfus & Dreyfus, 1986). The Traditionalist, Jenny, was unique. Although she considered herself a novice and was cautious about making decisions without the guidance of her mentors, she drew from her ID experiences to consider multiple influences when approaching problems and alternative solutions. The Traditionalist had begun to internalize the rules and procedures she followed and thus, as the proficient performer (level four) in the Dreyfus model, she was beginning to use her previous experiences to make intuitive decisions (Dreyfus & Dreyfus, 1986). The Practitioner exhibited some characteristics of the novice designer, who bases his or her judgments on surface issues that are immediately apparent (Chi, Glaser & Far, 1988). The Practitioner is similar to the advanced beginner (level two) in the Dreyfus model, drawing from previous experience, but requiring guidelines to perform at an acceptable level (Dreyfus & Dreyfus, 1986).

Innovators. The Innovators considered themselves lifelong learners and viewed their graduate experience as a foundation for practice and continuing their education. Their most noteworthy characteristic was their pride in their profession and the products they created. As did the experts in the expert-novice problem-solving research conducted in the early 1990s, the Innovators were not afraid of ambiguity; they approached each new challenge anticipating that there were multiple influences and solutions to any situation.

Whether the project called for new, original materials, supplemental activities for existing content, or repurposed coursework, the Innovators extracted as much information as they could about the target audience and their learning or work environments. Expert instructional designers often spend more time than novices on the needs assessment because they interpret problems as ill-defined and consider multiple factors that might influence the situation. They also spent more time on the front-end analysis of the tasks that the learners need to perform (Rowland, 1992; Tripp, 1991, 1994; Perez, 1995; Perez & Emery, 1995; Quinn, 1995).

Experts guide practice by creating mental prototypes that integrated prior experiences with their technical and practical knowledge (Boreham, 1987). This process requires both intuitive and analytical skills to analyze the complex situations that exist in actual practice and identify novel solutions (Hammond, 1980; Dreyfus & Dreyfus, 1986). Laura attributed her ability to push the envelope to her experience as an improvisation comedienne and Josh found creative ways to adapt experiences and knowledge from other disciplines to identify needs and create new solutions for his clients. Casey accomplished this by surrounding herself with experts (she saw all of her colleagues as potential teachers), encouraging collaboration among her team members, and guiding them through the ID process. Likewise, all of the Innovators helped their colleagues see "outside-the-box" by taking risks and guiding them in creative explorations of the design process. Since the Innovators were confident in their expertise, the expertise of others did not intimidate them and they welcomed collaborators' contributions to the creative process. This aspect of expert practice has not yet been explored in the research into expert-novice development.

Practical knowledge is an intuitive artistry involving the interpretation of theories and methods within the expert practitioner's domain of practice and adapting them to meet unique specific needs (Brumbaugh & Lawrence, 1963). The Innovators were similar to Pitlik's (1995) "Adapters" in that they had confidence in the ID process, "it can be effective in almost any situation" (Josh), which they see as utilitarian rather than prescriptive. They did not allow an ID model to dictate how they practiced design, rather they adapted what they learned from the model to interact with a situation and their colleagues. The "Innovator" differed from the "Adapter," however, by adapting ID methods and strategies *within* each stage of the ID process rather than adapting to the process by foregoing critical stages of the model such as front-end analysis. "If you look at it in pieces, each of the pieces is adapted in some way" (Casey).

Shifts in the way organizations function in society, such as the technology and communications explosion, a global economy and shifting employee roles, continue to influence the evolution of the instructional design profession (ASTD, 1993). The concept of change in organizations is a constant, and organizations' members must have the skills necessary to increase efficiency and productivity while identifying innovative solutions that will give them the competitive edge in their market (Davies, 1997). Instructional designers must meet similar demands, but they also need to function as change agents who can guide employees in the development of their problem-solving skills, their ability to meet new challenges and the development of their lifelong learning skills. The Innovators in this study seemed best equipped to meet this demand because they exhibited the ability to lead their colleagues in the process of identifying needs and designing effective solutions. The Innovators founds ways to create efficient and timely instructional solutions by adapting to the ID process, yet they tried to do so without sacrificing the integrity of the instructional materials they created.

Traditionalist. Like the Innovators, Jenny fully embraced the ID process as a collection of methods and strategies for defining problems and identifying solutions. She considered herself a novice designer, however, and was cautious about moving forward on her own. In the areas in which she felt competent, whether note-taking during needs assessments, conducting preliminary task analyses, or designing instructional strategies, Jenny paid careful attention to detail and sought to emulate the expert designers who guided her projects.

Jenny felt her graduate experience might have been more transferable to professional practice had she been cognizant of her professional needs rather than limiting her focus to her current interests at the time. Despite the limitations Jenny set upon her own graduate experience, she still felt the foundation she gained in ID enabled her to enter the field. Osman and Hannafin (1992) explained that expertise develops over time as the novice works through problems that progressively increase in difficulty. Under the guidance of experts, the skills are internalized with each new experience. This foundation prepared Jenny for a life of learning through continuing education and, more importantly, experience working as an apprentice to expert practitioners.

Practitioners. The Practitioners viewed their graduate experience as a foundation for practice, yet they felt that the study of instructional design was more of a means to an end, their degree, rather than a part of their lifelong learning experience. Instructional design, they felt, enabled the Practitioners to enter the field. It also "provided a framework for the process" (Anne, Chris) and "without this background knowledge, you run the risk of designing something that is not instructionally sound" (Sharon).

The Practitioners' focused their continuing education on remaining current with the latest technologies and learning theories related to their definition of ID practice in the "real world:" instructional strategies, interaction and interface design. They agreed that ID, "in theory," influenced their decision-making, but felt that the systematic ID process they learned in school had limited application in a client-based, corporate environment. The Practitioners attributed this to the expectations of the clients who usually "internally identified the need and solution" because "they know exactly what they want presented and they have the content for us to create interactions (Sharon)."

Novices characteristically interpret problems at face value and consider few influencing factors, one at a time. They tend to move immediately to the generation of solutions and attempt to apply them (Berliner, 1986, 1991; Chi, Feltovich, and Glaser, 1981; Schon, 1983, 1987; Chi et al., 1988; Eraut, 1994). Likewise, the Practitioners took design problems at face value and did not question the client's instructional objectives or proposed solutions. They firmly believed that "the client drives so much of everything (Chris)" and "actually having real clients makes it less likely that the instructional design process is going to be followed (Sharon)."

This was the most noteworthy characteristic of the Practitioners, yet it is the most difficult to understand. Although they had similar graduate experiences to the innovators, (Chris and Sharon [Practitioners], and Josh and Casey [Innovators] attended the same graduate program) the Practitioners' description of their approach to the ID process was reflective of novice problem-solving characteristics. They described their process in concrete terms and tended to see single factors influencing situations and driving instructional solutions (Berliner, 1986, 1991; Chi, Feltovich, and Glaser, 1981; Schon, 1983, 1987; Chi et al., 1988; Eraut, 1994). This difference suggests that the Practitioners develop expertise at a different rate than their counterparts, the Innovators. Factors affecting this discrepancy may include the climate of the instructional designer's work environment, projects or individual personality traits. Chris and Sharon, for instance, entered a work environment that focused on projects that supplemented existing content. Coupled with their perception that instructional design in actual practice begins with instructional strategies, they did not consider alternative needs or solutions to the learning needs they were addressing. Anne was a Practitioner who felt that she was a novice instructional designer looking to her graduate experience to guide her actions in her new job. Her previous job did not require her to employ the entire ID process and she believed she developed habits that compromised the quality of ID, such as moving directly to the design and development of instructional solutions. Innovators Josh and Casey, on the other hand, found opportunity to adapt each stage of the ID process to extract the information they needed. Josh demonstrated his skills to potential employers and they hired him as both instructional designer and content expert. As a result of his dual role, he found that he had considerable influence on client decisions about the ID process and their selection of alternative solutions. Casey responded to the environment where she worked, by leading experts from a diverse range of disciplines through the ID process.

Like the advanced beginners described in the Dreyfus Model of Skill Acquisition (Dreyfus & Dreyfus, 1986), the Practitioners followed the rules they understood. They practiced their craft by organizing content and designing the "presentation" and "interactivity" based on the clients' guidelines. They did not see the ID process as a way of exploring a situation in multiple ways. They valued its structure, yet considered it an ideal, a "theory," that could not exist in a world where the primary source for the need and identification of the solution was the client and/or subject matter expert. For Anne, this discrepancy between academic preparation and practice diminished her sense of accomplishment because it made her "feel guilty about the product that you produce in the commercial world."

Skills learned on the job. The most common skills the participants learned on-the-job were the collaborative, management and interpersonal skills. The participants also noted that several of the skills they learned on-the-job expanded upon the foundations they formed in graduate school. This included technology as well as ID related skills such as learning theory, research and evaluation. (It is important to note here that some gaps in this analysis may exist because a respondent did not comment on it rather than indicating that this skill was not learned on the job.) Laura expressed this sentiment about her technology skills, "I think there is definitely a technology learning curve that never stops," and most of the participants anticipate that this knowledge base will continue to grow throughout their careers.

Participant Recommendations. Most of the participants pointed to a need for courses that address the dynamics of professional practice and prepare them for the challenge to continue developing these skills on-the-job. Several of the participants, for instance, noted a discrepancy between their academic focus on K-12 applications of instructional design, and their application of adult learning theory and in actual practice. All but one participant thought they would be working exclusively with K-12 learners in professional practice and, consequently, none of the participants sought additional coursework in adult learning while they were enrolled in graduate school. And, as one participant noted, employers often assume that graduates of instructional design programs have a background in adult learning theory and exposure to methods that can meet the needs of the diverse target audiences they encounter in actual practice.

Organizations today are focusing on their future by creating work environments that encourage collaboration, teamwork, and shared knowledge. Skills in the areas of human relations, social intelligence, are critical to successful professional practice. With the exception of Jenny, all of the participants found that team building and collaboration were significant components of their professional practice. (Jenny anticipated that she too would need these skills as she moved into a project management role in the future). Consequently, they felt they were continually challenged to improve their professional interpersonal skills. Laura was the only participant, however, to attend a course in human relations; her college included this course as a part of the core curriculum. She noted that, although these skills had not fully developed when she began to practice instructional design professionally, the course laid a foundation for her interpersonal skills development. She was able to recall issues covered in class activities and apply these problem-solving skills to similar situations.

The participants noted several areas of project management that they developed on-the-job including client negotiations, delegation, scheduling, budgeting, and project projection, among others. Most of the participants recognized that project management skills are applied in complex multidimensional situations and, therefore, must develop in professional practice. They emphasized, however, that project management experiences in graduate school might provide them with the tools and methods that would ease their ease their transition to professional practice.

Recommendations: instructional methods for academic programs. The instructional designers in this study entered their graduate programs without an understanding of instructional design as a method or a profession. The vision of professional practice they held often influenced their perceptions of what coursework was relevant and guided their focus throughout their graduate programs. Consequently, they felt they were inadequately prepared in these areas of professional practice. Exposure to ID professionals when students enter their graduate programs could help novice designers build an accurate perception of professional practice early in their academic experience. Subsequent visits can focus on a variety of issues or environments of practice; as the students' conceptual and applied understanding of the ID process and related disciplines increase, so will their depth of inquiry about professional practice.

Most of the participants in this study assumed that, as an instructional designer on production teams, they would play a significant role developing components for products. A panel discussion with a production team, including designers, project managers, and developers could help students understand the interrelationship between designers and developers in actual practice and the skills an instructional designer applies to this stage of the design process.

The results of this study suggest that multiple factors, including learning readiness, prior experience and learning styles, can affect the novice designer's reception and cognition of these disciplines as foundations for professional practice. While some participants were able to draw connections between the core topics they covered in their graduate studies and ID practice, some interpretations misled them. For instance, the perception that the ID process is separate from the design and development of technology-based instruction or the conception that constructivist learning environments require opposing design methodologies to the ID process. Most of the participants did not draw critical connections until they began professional practice. Some participants never drew these connections. This suggests that novice instructional designers would benefit from an increased focus on the relationship between the concepts and skills they are learning and actual practice.

Connections between specific content areas need to reflect how each area influences actual practice. Professional instructional designers do no apply their ID, learning theory, technology, or project management skills in isolation; these skills and knowledge are interdependent and interrelated. IT programs and instructors can help the beginning designer understand this interrelationship by modeling application of the various disciplines in each of the core IT classes. This strategy should begin when students enter their graduate program. A survey course on the history of the field, such as the course Josh described for instance, can provide a global understanding of the role each foundation holds in professional practice. The interrelationship between the theoretical and practical knowledge of the field can then increase in complexity as the students move into advanced courses, and from exploration towards actual application of these skills in the design and development of instructional materials.

The adoption of such an integration strategy might, in many IT programs, place a significant demand on IT instructors by necessitating increased collaboration in the design and implementation of the program area courses. One possible alternative is a method that I explored in the University of Virginia ID course that I have co-facilitated; we added a lab to the core ID classes and used this time to facilitate student explorations of the practical relationship between their ID and the other disciplines. Again, student response to this opportunity was enthusiastic, although it required considerable guidance to keep the students on track and engaged in each others' explorations. This method could be applied to all of the core IT classes and, although there were be overlap in some instances, the students would begin to understand how these concepts apply to professional practice.

Several of the participants in this study also indicated that the skills and knowledge they developed in graduate school were only the building block for a foundation that they expect to continue expanding throughout their career. Student resource portfolios, another method that we applied in the University of Virginia ID courses, can help novice instructional designers organize their academic course materials so they can serve as reference materials for this ongoing exploration. In addition to their use as a resource for professional practice, the process of creating the portfolio requires the novice designer to analyze the materials and consider how they might apply to actual practice. This can increase the relevance these topics hold for the novice instructional designer. It can also serve to demonstrate that the foundation acquired in graduate school provides a framework for lifelong learning.

Prior research into the development of practical knowledge and professional and ID skill development suggest that experiences reflecting actual practice are critical the development of a professional designer. Likewise, all of the participants recommended experiences reflective of professional practice and most of them recommended real-world ID projects with actual clients. The participants who had this opportunity emphasized their appreciation for their instructor-coaches who led them from simple to complex applications of the ID process and provided guidance and feedback that encouraged them to consider multiple perspectives and potential solutions.

In addition to the real-world projects, many of the participants' programs offered credit for internships in work environments thought to reflect the type of work environment the student planned to enter in professional practice. Internships can provide novice instructional designers with experience applying the technical and practical knowledge expected of professional instructional designers. On the other hand (and as evidenced by one of the participants in this study), internships may not always provide the student with an experience reflective of professional practice in instructional design. This investigator contends that the instructor should ensure the student is placed in the appropriate work environment. Under the guidance of a university professor who can encourage reflection on practice and analysis of the experience, the intern can successfully explore the dynamics of professional practice.

The participants in this study also described their struggles with a variety of challenges including project management, client negotiations, team dynamics, and ID projects in environments that were foreign to them. Other fields such as business, law, and medicine and, more recently, the field of instructional design, have demonstrated the effectiveness of case-based learning. Case studies present realistic narratives of real world situations and problems. Case study analyses facilitated by instructor-coaches can expose teams of novice instructional designers to multiple environments. Teams can explore messy situations in a safe environment and gain experience solving the types of problems they may encounter in actual practice.
As the participant, "Laura," explained, she drew from case study experiences that addressed issues similar to the challenges she faced in actual practice.

Future Research

This study of instructional designers' perceptions of academic preparation and practice has been reported with an emphasis on the transfer of skills and knowledge developed in graduate school to actual practice and those skills practitioners developed on-the-job. It was found that ID professionals, who are assured of confidentiality, might be open, honest and willing to reflect on their successes and failures as instructional designers. Despite significant differences between each participant's experiences, several common themes emerged suggesting that IT programs are addressing many of the skills that novice instructional designers employ in professional practice. This is in line with prior research into the competencies of professional instructional designers (ASTD, 1983; IBSTPI, 1986; Atchison, 1996).

This study provided a glimpse into the professional lives and academic preparation of instructional designers who develop instructional materials for external clients including products for educational publishers, government and related industries, and entertainment clients, among others. The dynamics of ID practice vary significantly across practice environments and each situation presents unique demands for the ID practitioner. Further qualitative studies addressing a variety of practice environments will provide data on the relationship between academic preparation and these specific work environments. The investigation of additional ID work environments can help to identify the variations in professional ID practice. Subsequent comparisons across practice environments will enable us to increase the generalization of our findings to multiple environments in the field. It would also be interesting to develop detailed case studies about the production and development of an entire project in each of these environments.

This study presented a variety of academic environments and stressed the need to establish the relevance of the theories, concepts, and procedures explored in graduate IT programs by demonstrating their interrelationship and interdependence in ID practice. Further studies into the structure of academic programs and the interrelationship of the curricula is warranted. This study identified some of the teaching methods that are perceived to be effective in learning ID and pointed to some teaching methods that are thought to be ineffective by some designers. The result of this study also suggests further research in this area. A profile of the professional instructional designer is ripe for investigation. An exploration in the relationship between ID students and the three profiles, Innovator, Traditionalist, and Practitioner can help provide insight into the characteristic of successful transfer from preparation to practice.

This study paralleled prior research that identified proficient designers as flexible and adaptable, able to solve complex ID problems in a diverse range of environments, and create innovative solutions. It was found that instructional designers may begin to develop these skills through instructor coaching, guided reflection, and experiences that emulate actual practice such as real-world projects and case studies. For some instructional designers, these methods, along with the foundations, skills and knowledge that novice designers develop in graduate school and in their early years of practice, enable them to apply what they learn to professional practice and lifelong learning.

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TEACHING, LEARNING, AND COMMUNICATING IN THE DIGITAL AGE

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Abstract

Younger students live in a media-centric world. Researchers have shown that youth today spend more time watching television and movies than most any other leisure-time activity (Pearl, 1982). In addition, the presentation speed of passages on commercial television has increased significantly in the past fifty years (Stephens, 1996). Researchers have shown that viewers automatically learn to cope with symbolic presentation methods through repeated exposure to television and visual patterns (Abelman, 1995; Bargh, 1988; Carr, 1982). Because of their increased exposure to rapid sequence and presentation speed brought on by fast-cuts/montage found in television programs aimed at youth, it may also be assumed that these individuals can comprehend these messages on a much wider scale than can their adult counterparts. One cannot assume that exposure to rapid presentation speed is simply a passive viewing activity. Further, not only are these advancements in media technology changing the way viewers look at and interpret video media, but most importantly, the widespread availability of production techniques provide easy access to capabilities that allow people to use video media to easily create their own content. It has been widely shown fashion (Tyner, 1998) that these acquisition/production opportunities also increase exponentially one's ability to comprehend content delivered in like.

Media educators and theorists for years have been analyzing Marshall McLuhan's famous quip, the medium is the message. In some regard, McLuhan's statement may be a retort to later critics of educational media like Richard Clark (1983) who claimed that media are "mere vehicles that deliver instruction but do not influence achievement any more that the truck that delivers groceries causes changes in nutrition" (p.445). Further, communications theorists like Walter Ong (1982) not only agreed with McLuhan, but extended the meaning of McLuhan's message to also imply that the types of media people use define the way they think. Ong's notions bring to mind possible questions as to whether today's mediacentric youth perhaps think differently than previous generations, with implications as to the kinds of instructional strategies that will be successful in motivating them to learn and providing perceptual stimuli for recognition and recall.

Background

Media educators and theorists for years have been analyzing Marshall McLuhan's famous quip, *the medium is the message* (Meyrowitz, 1985). In some regard, McLuhan's statement may be a retort to later critics of educational media like Richard Clark (1983) who claimed that media are "mere vehicles that deliver instruction but do not influence achievement any more that the truck that delivers groceries causes changes in nutrition" (p.445). Further, communications theorists like Walter Ong (1982) not only agreed with McLuhan, but extended the meaning of his message to also imply that the types of media people use define the way they think. Ong's notions bring to mind possible questions as to whether today's mediacentric youth perhaps think and cognitively perceive differently than previous generations, with implications as to the kinds of instructional strategies that will be successful in motivating them to learn and providing perceptual stimuli for recognition and recall.

The increased predominance of digital technology in our daily lives is no accident. In 1996, the Federal Government mandated, through the Telecommunications Act of 1996, major changes in the way television signals are to be transmitted. Digital and high definition (HDTV) television would become the standard by 2006. In exchange for the broadcast industry having to absorb the multi-millions of dollars in cost for this conversion, the FCC also made significant favorable changes in limits on cross-ownership, which have encouraged an overall industry-wide consolidation. The end result has been a phenomenon called *digital convergence:* the combining of the telephone, the computer, and television into one technological *box*. Alan November (1998) re-labeled this new technological machinery, calling it a "Digital Combine", in obvious reference to the agricultural combine that was invented during the 1930s. Traditional farmers who worked the land by hand fought this advancing technology as depicted so well in the movie The Grapes of Wrath. In a famous scene the character, played by Henry Fonda, was complaining to the other squatters that these new Cats were pushing them off their land. November's analogy is clear. Educators who cling to (i.e. squat on) their old ways will suffer a similar fate and will be pushed off their turf if they do not learn how to co-exist with the latest technological *cat* - new media technologies that are so prevalently being used and mastered by today's youth. A change in educational techniques is inevitable. What must be done is to figure out how and when, not if, this new *combine* will be incorporated into instructional designers' thinking about the current batch of students, who are steeped in exposure to new media.

As a result of digital convergence and other new ideas, the predominant types of production techniques in use today in electronic media are changing. Encouraged by the successes of early pioneers of rapidly paced music video montages on networks like MTV, VH1, and Nickelodeon, and helped by rapid advances in technology, today's television producers regularly communicate fairly complex messages using fast-cuts and video montage (Stephens, 1996). Significant increases in viewership of these types of programs appear to be providing fertile opportunities for today's youth to practice their ability to receive and understand this fast-paced message delivery. According to Seward-Barry (1997), sleeping has become the only activity that occupies children’s time more than watching television (or, more recently, playing video games). For these reasons, a change in the way in which educators look at learning from electronic media may be warranted. This thinking appears to be incompatible with earlier communications theorists like Edgar Dale (1969), who felt that television finished somewhere in the middle of a twelve-point influence scale in its ability to convey contextual ideas. Moreover, using television in education appears to be anathema to recent spokesmen like Neil Postman (1986), who feel that it adds nothing positive to the mix and may even be detrimental to learning and cognition. However, new media that employs visual imagery supplemented by motion, sound, and computer editing is perhaps finally positioned to evolve into a similar definitional prominence to the peop le who use them, just as print media had done for the past five hundred years since Guttenberg (Stephens, 1996, p. 69). Corcoran (1981) suggested that intelligence is a skill in a particular medium and that symbolic codes used in that medium that serves communication purposes and are internalized by a receiver also serves as a authentic tool of thought. This new way of thinking may be at the root of generational differences in communication techniques and over-dependence on the right brain for thinking in today's youth. It has also brought to mind a revelation on the part of this author. Just because a student does not know the words to communicate his or her thoughts does not necessarily mean that he or she is not having any intelligent thoughts. Perhaps, the ideas are coming to these individuals in different ways. Investigation and follow-up has made some things much more clear. Educators need to look differently on communicating and educating today's mediacentric youth.

The Medium is the Message Re-visited

The idea that the learning process might be changing as the result of the types of predominant media being used is appears to be backed up by several research studies by Jonassen (1996) and others in which technology/media has been successfully evaluated as type of cognitive *mind tool*. In other words, by merging many formerly distinct knowledge situations, new media appear to be “breaking down the boundaries among various disciplines, opening new dialogues, and fostering the development of cross-disciplinary areas of study” (Meyrowitz, 1985, p. 327). These new kinds of electronic media, Meyrowitz (1985) speculated, may be "introducing our children to a different way of thinking that involves the integration of multiple variables and overlapping lines of simultaneous actions" (p. 326). This assertion proposes, among other things, that electronic media in general (and television in particular) may have already greatly reduced the influence that time and location used to have on what people know. It is, therefore, not unreasonable to propose that a transition may be in process in which the youth of today think about things, all of which appears to be at odds with the linear thinking processes associated with print media (Stephens, 1996). Further, it is also possible that today’s youth may be moving away from a “one-thing-at-a-time, one-thing-after-another, and take-time-to-think world of reading" (Meyrowitz, 1985, p. 326) towards McLuhan’s world of “interconnected layers of information” in which “a continual superimposition of complex contextual matrices, all arrive (sic) into the brain at an electric speed” (McLuhan, 1964, p. 91).

The Medium is the Message, Part 1

Perhaps the best way to analyze the impact of new media on teacher youth in the digital age is to re-look at McLuhan's *medium is the message* ideas with a view to some modern interpretations. One interpretation of the medium is the message concept involves how we should evaluate the innate goodness or badness of the media we use. In general, this assessment can be interpreted in four ways. Technology (As an aside, the terms technology and media/new media should be inter-changeable here) needs to be assessed in the following ways:

- What, if anything, new does it bring to the table (i.e. what good is it doing for the culture who is using it?)
- What does its introduction into a culture make obsolete?
- What, if anything, does it bring back that might have been obsoleted by a previous new technology?
- What happens when people using this new technology over-depend on it?

In most general terms, this interpretation of the usefulness of technology has very specific implications for educators who are looking into teaching and communicating with today's media-centric youth. First, new media provide complete interactivity at a very small price. Without having to leave their classrooms, students can interactively explore cloud formations that occur during major hurricanes, compare bone structures between humans and apes, look at generational genetic similarities, and explore the human body in very dramatic form. Streaming video and the Internet are helping to redefine the distribution of educational materials. For example, the National Library of Medicine at the University of Maryland has put online the Visible Human Project, in which students can view an actual human's anatomy from the top of his head all the way throughout to his feet, using cat scan technology that has been exported to a Quick Time Video. These virtual field trips are becoming increasingly prevalent and commonplace on the Internet. Second, new media technologies (the Internet, in particular) appear to empower and encourage students to communicate using the media. Producers of new media are offered broad new opportunities to immediately practice their skills through ready-made distribution channels for a new population of motion picture and video practitioners. Marc Davis from the MIT Media Labs likened his phenomenon to that of younger musicians practicing in their garage. "In the spirit of garage bands, the Internet and new video technologies provide ready-made distribution channel for a new pop ulation of motion picture (and video (sic)) producers, as practitioners of garage cinema" (Davis, 1996). A more famous example was the way that the Blair Witch project got off the ground, using the Internet first as a means to introduce and market the product prior to its general release in major movie houses across the country. Several Internet sites like Always I.com are popping up that encourage amateur producers to post their work. No longer do today's youth have to wait to grow up and move to Hollywood in order to get their works published. These new opportunities are encouraging youth all over the country to create and communicate using media technologies. Classroom teachers need to tap into these opportunities and role models to make connections with their students, who are already spending considerable amounts of their leisure time in these activities.

If one follows John Keller's ARCS motivational model (Keller, 1983), it shouldn't be too hard to see how relevance and success with new media may be translated into making successful connections with today's mediacentric youth. A word of caution - new media cannot be looked at without also keeping in mind the fourth law of media evaluation mentioned previously. Over-depending on new technologies does have its downside. New media tends to affect right-brain development, whereas text-based cognition is left-brain. An over-dependence on one side or the other is not fully developing one's potential and can leave a child ill equipped to fully function in the world. As Robert Doman, Jr. (1984) very often preached, one should teach to one's strengths and remediate any weaknesses, and not the other way around. A failure to do this is doing our youth a disservice.

Teach to the Strengths, Remediate the Weaknesses

The obvious point here is that educators should teach to a student's strengths (i.e. right-brain development) I order to remediate their possible weaknesses (i.e. text-based or left-brain cognition). Use visual skills to get at textual. Using media as a cognitive development tool has incurred significant success in several literacy projects recently. These projects utilized students' fascination with the technology of television and video production as a hook to encourage them to develop their non-verbal (i.e. oral and visual) story-telling skills that eventually translated into their acquiring increased text-based communication abilities. These students haven't needed too much prompting to want to write about their own personal visual experiences and/or story lines. Marco Torres' work with inner-city youth in east Los Angeles, as well other similar projects in San Antonio, Texas, and in Ohio have been very successful in bringing otherwise lost children back into educational the fold so-to-speak. By first teaching students how to communicate non-verbally and then having them utilize their own projects to develop their verbal communication skills has paid big dividends.

Remediating weaknesses and learning disabilities appears to be another way that new media has helped shape personality and development. For example, researchers have found that video games can interact with subjects to positively influence cognition. Physicians and researchers at the Medical Center at the University of Eastern Virginia have been able to attain significant results in treating ADHD students with a non-invasive, non-medical treatment using video games to increase attention spans and to increase cognitive activity. Subjects are hooked up to bio-feedback apparatus that monitors attention while they play popular video games. As subjects' attentions drift, the feedback mechanism makes the joystick attached to the game more difficult to operate. The subjects are prompted to again attend to what they are doing. They are incented to stay on task because of a built-in desire to play the game. Positive long-term effects appear to warrant the use of this program to cause subjects to change their cognitive behavior (i.e. attending to a task) relative to capabilities and habits prior to entering the program. Most can be taken off therapeutic medications in the process.

Research appears to back up these projects. While some have deprecated the over-use of media (Dale, 1969; Neuman, 1976; Postman, 1986)), others (Gropper, 1966; Nugent, 1982; Paivio, 1986) have found that the use of video media can actually increase one's retention for stories presented via the combination of visual and auditory information that those presented through only a single source. It is, perhaps, that new media is finally positioned to take its place in education because the availability of easy-to-use production techniques are finally beginning to rival those in other communication vehicles like word processing. What appeared to have taken over five hundred years (from the invention of the printing press to word processing) has only taken video media a little over fifty to accomplish (Stephens, 1996).

The Medium is the Message, part 2

A second interpretation of the medium is the message concept is that the medium one uses to communicate not only helps to define the message, but also those who utilize that medium. The impact of new media in this manner can be demonstrated in several ways. For example, some researchers have looked at this interpretation and came up with the idea that increased usage and dependence on this form of media might be a two-way street. Two Stanford University researchers have looked into media interaction and examined the way people respond to media and media events. While we can readily apply knowledge gained from media experiences to real life, Reeves and Nass (1996) found that we also apply experiential knowledge gained from real-life to the use of media. Among other things, they examined cultural experiences like politeness, flattery, and negativity and found that people essentially react to media in identically the same ways they do to other people. First, their studies indicate that when a computer asks a user about itself, users will respond more positively than when a computer asks about how well another computer is doing. In other instances, people believe they did better on a computer-based test when the computer flatters them than when the computer offers no evacuation. Moreover, people seem to like a computer more, and believe it did a better job when it flatters them, whether or not the praise is warranted had no effect. Third, people were found to pay attention to, and remember negative media better than positive media. Additionally, people were found to have a better memory for information that follows negative media than for information that follows positive media and vice versa. Lastly, Nass and Reeves showed several instances when media personalities are more often identified solely through the media roles they play, to the extent where they cannot cause people to identify them by their real names. Perhaps what the *media equation* is telling us is that we need to broaden the context of what it means to be literate to new forms of media and to relate to media just as if it is a real agent in our daily lives.

The Role of Media in Education

In spite of these findings, researchers and educators looking into the intrinsic instructional value of video media have presented conflicting views with regards to the role visual perception plays in attention, motivation, and recall. There have been several studies that looked into the potential benefits mediated coding systems have on cognition (Davis, 1999; Nugent, 1982; Paivio, 1986; Seidman, 1981; Walma van der Molen, 2000). On the other hand, early theorists have had little good to say about television's ability to bring anything new to the table with regards to using it as an educational medium (Berlo, 1960; Calvert, 1989; Ide, 1974; Kozma, 1986). This may have been due to the limitations imposed by the technology in use at the time. Technological advances in commercial television production techniques that allow today's producers to readily integrate fast-cuts and montage have added to this benefit/conflict controversy by providing them tools to more easily communicate complex thought using a non-verbal narrative structure. A rapidly cut montage passage has been found to add clarity to a passage because the interpretive whole of the segment is more than the sum of its parts (Hitchon, 1994; Stephens, 1996). In other words, it is the composite whole of all the visual images in a passage or segment, considered at all once, that gives extended meaning to the montage. In addition, newer ideas on editing techniques have evolved that emphasize more the perceptual continuity of a non-verbal composite narrative structure rather than the classical point of view, which stressed the importance of applying strict editing rules in order to obtain smooth transitions between successive shots (d'Ydewalle, 1990).

Fast-seeing as Cognitive Activity

Studies need to be designed that will that will, hopefully, extend into an educational setting recent studies of casual viewers' ability to absorb and comprehend complex, rapidly-presented visual passages. What can educational video producers learn about presentation speed and editing from current commercial television production trends that incorporate an ever-increasing number of these fast-cuts and montage passages? Is it possible to recognize, recall, and get the gist of intellectual content solely from rapidly paced visual montage that is not supplemented with some form of verbal narrative? How does one's learning/cognitive style effect his or her ability to process fast-cuts/montage video presentations in a classroom setting? Most of the previous studies into the impact of fast-cuts/montage have concentrated on commercial television viewing (Bryant, 1991; Lang, 1998; Lang, 1999; Lang, 2000; Zillman, 1991). While there have been occasional studies (Keller, 1976) into the use of fast cuts/montage in an instructional setting, they have looked at viewers as a collective whole with little regard for differences in audience personalities, capabilities, cognitive style, or personal traits. Further, the subjects of all earlier studies in either setting have been college-level students enrolled in communications classes (Keller, 1976; Lang, 1999; Lang, 2000; Reeves, 1996), rather than school-aged students viewed in their original educational environments.

Construct-related Validity of Leisure-time Studies

Media researchers have looking into the benefits of rapid presentation have had to contend with a conflicting view that holds that the relatively fast presentation speed of televised programs creates an environment that may be detrimental to attention and recall (Alwitt, 1980; McCollum, 1999; Neuman, 1976). To the contrary, others have shown that presentation speed and rhythmicity in leisure-time media can actually heighten enjoyment, enhance motivation, and can "play an important part in determining the affective or emotional response of message receivers" (Seidman, 1981, p. 49). Intraub's (1999) recent studies into conceptual masking have shown that humans are able to recognize and recall pictorial presentations when a minimal amount of lag time separates individual images. There are those who believe that there have been several successes with childrens' programs that offer rapid and rhythmical presentation speed (Anderson, 1979; Anderson, 1983; Anderson, 1988; Pearl, 1982). Moreover, it appears that there exists a direct link between one's ability to comprehend televised messages and, in fact, overall academic achievement and one's innate cognitive (i.e. personal) tempo (Flowers, 1995; Shaffer, 2000, August 19; Snow, 1965; Wagely, 1978). Others contend that presentation speed in instruction may add interest to otherwise uninspiring content (Canelos, 1986, January; Edgar, 1997; Hawkins, 1997; Hill, 1993).

Still others have looked into presentation speed as its own construct, comparing/combining it to/with arousing content (Lang, 1999; Lang, 2000). Further, Lang (1999; 2000) discussed the effect of adding interesting and arousing content as having a positive effect on cortical arousal and, therefore, recall and recognition. In additional studies, Lang (2000) alluded to future research that should continue to probe the shape of the relationship between presentation rate and recall and test even faster rates of edits to determine whether there is a point at which memory begins to decline. Her studies suggest that producers who want their messages to be remembered should create arousing messages that are slow or medium paced, or calm messages that are medium or fast paced. She concluded that producers should not create messages that are either calm and slow paced or arousing and fast paced (Lang, 2000). The current study will look into the effect of integrating increased message presentation speed directly into instructional messages in an educational environment whose content might be considered by some students as less than arousing. It should also be noted that Lang (2000) considered cuts to be *fast* if they changed at a top rate of eleven to twelve per thirty-second segment (i.e. one every 2-3 seconds). While these studies are important in their own right, perhaps their speed of presentation may not be fast enough, considering an observation by this author that current trends in television editing techniques tend to present images almost ten times as fast.

Lack of Correlation in Educational Settings

These investigations into the effects of casual television viewing have not translated too well to the educational setting (Salomon, 1994). As Kozma (1986, p. 14) had stated, "viewership should not be confused with learning". However, once one delves deeper into these studies, four possible reasons for this lack of generalizability become apparent. First, the reputation commercial television has held for being nothing more than an entertainment device has certainly hurt its reputation in educational circles and has caused detrimental pre-conceived notions about how viewers are to be properly introduced to televised content (Wetzel, 1994). Second, many of the schema used in commercial television are considered by some to be nothing more than prototypical, trite, and overly familiar formulas that reduce the attention and concentration because they have been over-learned (Anderson, 1979; Langer, 1979). In these cases, encounters with overly familiar information formats "lead one to revert to a mindless routine in which the material is ignored or receives a low level of attention" (Wetzel, 1994, p. 169).

This alleged over-familiarity with format has lead many educators to believe that viewers will have difficulty responding appropriately to educational televised presentations, unless some form of intervention is used (Wetzel, 1994). Third, in many studies into casual viewing, there has been a tendency to lump all viewers into a single category (Lang, 1998; Lang, 1999; Lang, 2000; McLuhan, 1964; Neuman, 1976; Tyner, 1998; Walma van der Molen, 2000). Classical instructional models tend to validate the value of segregating learners and classifying them by their individual differences (Gentry, 1998; Joyce, 2000).

The fourth, and possibly most important reason for the lack of correlation between studies of casual viewing and those performed in an educational setting is that the learning environment is thought to present a different set of circumstances - a different view if it were. This is based on the importance placed on the medium to be evaluated as to its unique ability to bring about some type of alteration of intellectual behavior or thinking process. Although many of the symbolic (i.e. intellectual) combinations found in non-verbal endeavors such as music, painting, and dance can be displayed directly on television, there has been some question as to the extent to which transformations in the thinking process are created in viewing, and whether any changes that might occur are of any significance (Ide, 1974). In other words, television has not been given credit for yielding any new intellectual construct of its own. Previous studies into the value of using television as a medium for intellectual change have demonstrated mostly *negative progress* (i.e. television does not actually *interfere* with learning, nor is it no less effective than other forms of media) (Thompson, 1996; Wetzel, 1994).

Rapid Presentation as a Construct

Although there appears to be a dirth of studies looking into the conflict/benefit of rapidly-presented visual images in educational settings, there does exist some research that clearly demonstrates the potential instructional value of video that is aided by a systematic variation of presentation speed of as a valid instructional strategy (Comstock, 1978). Intraub's (1999) experiments into individuals' ability to understand and remember briefly glimpsed images dealt with pictures that were not or only very loosely related. The use of montage implies that the pictures included are at least conceptually related. Intraub (1999) indicated that subjects might be able to hold more than one picture at a time in a conceptual buffer, so long as the "series was not too long" (p. 57), and the notion that the included pictures were related to one another. It appears that humans may have the ability to construct meaning from these types of presentations through the use of interpretive coding (i.e. the process by which meanings are put together from specific parts of visual communications). In describing his research in teaching Native Americans how to use film to communicate meaning, Sol Worth (1997) noted that the process of coding has been neglected in the study of most of the fine arts, including film. His comments appear to be alluding to the fact that the form of a medium might be what carries meaning. In an earlier attempt to extending this notion to television, Pearl (1982) discussed the relationship between form and content and admitted that it is the form (that is, the way it uses verbal and linguistic codes), not the content, of television that is unique. However, she also cautioned that form and content cannot always be distinguished - "no more than grammar and meaning in any verbal language can" (p. 24). However, she went one to say (Pearl, 1982) that some forms are unique to the medium and apply syntactical meaning only in the context of that medium. For example, slow motion is not real and its meaning must be learned. However, once learned, studies have shown (Barnett, 2000) that these formats become generally used by people in their own thinking (i.e. when one speaks of applying slow motion to a video message, it generally carries the same contextual or emotional connotation). The current study tries to apply the same logic to fast cuts and video montage to see if this presentation format can be interpreted in such a way so as carry the same or different implied meanings than slower paced messages.

Previous research into using presentation speed and movement in educational multimedia has been the subject of controversy in the literature (Downs, 1989). Downs indicated that there might be a new wrinkle on evaluating the findings: one must try to "determine if children are attending to motion but not expressing it" (p. 97). She alluded to possible future studies that should include additional cueing strategies to determine their effect on learning. Under very broad interpretation, the speed of message presentation of motion and edits/cuts may be considered a form of cueing (Lang, 2000). Previous research also referred to presentation speed in a similar way, referring to it as a message's domain "attribute" (Downs, 1989, p. 3). Salomon (1979) acknowledged that media attributes are that "within the mediated stimulus, possibly shared to some extent with other (forms of (sic)) media, and makes the presented information more comprehensible or better memorized by learners of particular characteristics" (p. 5-6). Under Salomon's definition, *symbols* include "most objects, marks, events, models, or pictures" (p. 29). It is assumed in this study that the rhythmic patterns afforded by fast-cuts are an *event*. Where the current study varies from Downs' is that it takes the interrogation of symbols and attributes to another level. The current study aims to show that rapid presentation speed (also referred to as fast-cuts) may be considered an invaluable attentional attribute of media and is, therefore, capable of being studied separately to discover its contribution to learning. In short, this study aims to determine to what extent the (rapid) presentation speed of video images either aids or interferes with learning, considering the changes that appear to be taking place in an ever-increasing mediacentric society. Another consideration is the way in which the effect on learning is to be measured. Mayer (1996) indicated that words might not serve as proper feedback format to visual motion cues. Archer (1965) proposed that other evaluative vehicles be designed that are more closely aligned with the visual processing because something may be lost in the translation to verbal. The current study will utilize a combination of verbal and non-verbal methods to evaluate its results that are more closely attuned to the visual perceptual process.

New Media, a new View of their Impact

Changes in media technologies create the need for taking a new look at it potential impact on education. Child development psychologists like Robert Dorman, Jr. (1984) have noted that it is no accident that tottlers learn more in their first five years than in any other time of their lives. The fact is that they perceive and process images very rapidly - at a rate that equals or exceeds a new one every 100-300 milliseconds. These observations beg the question as to what happens to this rapid learning process just about the time that a child enters his or her formal educative years. What do current educational strategies do to slow the learning rate down? Has previous research been hampered by a lack in technology to implement and subsequently evaluate rapid presentation as an instructional strategy? Some have expressed this opinion in the past. Loftus (1982) found only one doctoral dissertation, and no published work had taken place up to the time of publication of his review of the literature in 1984. The current author has found one more in a very recent research of the literature, and that one also took place before Loftus' work. The truth is, almost no research has been done in this area since then.

On the other hand, recent contemporary theories about fuzzy trace memory (Brainerd, 1990; Brainerd, 1994; Reyna, 1994) might be the key to looking at rapid presentation as an instructional strategy. Research has uncovered that as a child progresses through developmental stages, s/he begins to loose specific details of episodic memory, but general details of contextual information last much longer and actually become the sole extent to which a person recall previous events. Research into this child development phenomenon has alternately given rise to new thinking about human memory in educational settings. In short, fuzzy trace proposes that there might be two distinct memory tracks, one that deals with verbatim information, and another that tracks essential contextual (i.e. gist) information that aids in the process of synthesis and analysis. These studies have indicate that both verbatim and gist memory can be stimulated with very short bursts of visual stimuli. While verbatim memory might be subject to masking limitations, gist memory has been found to be much more durable. It is obvious that more work in this newly created field needs to be done before any specific changes in educational strategies can be made. However, successes in experiments dealing with numbers (Brainerd, 1994) and text (Reyna, 1994) are promising.

Summary

In spite of previous experiments into memory associated with rapidly-presented visual messages, the time might be right to revisit this field. We appear to be living in an age where information overload might be in vogue . Previous experiments were hampered by the lack of any stable technology to recreate for testing purposes in a consistent manner rapidly-presented visual imagery. That no longer appears to be problem. According to some, today's youth who live in this world not only appear to be attracted to the rapid pace, but also might have learned how to cope with it and utilize it as a more efficient way to take in information. Child psychologists studying right-brain activity (Shichida, 1993) have known for years that image training in infants produces remarkable mathematical and reasoning capabilities. In fact, the right brain can process cognition without any fixed memory. The right brain functions beyond one's consciousness. Processing rapid montage appears to be a right brain activity. In short, rapid montage video may be able to play a significant role in the learning process because it matches three essential elements of perception and learning:

- Frequency
- Intensity
- Duration

The rapid changes in visual stimuli have been shown to gain viewers' attention, and cause viewers to concentrate longer. Educational research may well benefit from discovering whether visual stimuli presented at an increased delivery pace can provide similar instructional outcomes in a more efficient and stimulating manner (Cobb, 1997). This is something that might be a more practical outcome measurement for using video media than achievement alone.

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Learners' Perceptions of Design Factors Found in Problem-Based Learning (PBL) that Support Reflective Thinking

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Abstract

Reflection involves active, persistent, and careful consideration of any belief or practice. It promotes understanding of underlying beliefs and application of new knowledge to new situations. Problem-Based Learning (PBL) provides the instructional mechanisms for prompting learner reflective thinking. This study found that young students perceived three factors as most important in supporting their reflection in PBL lessons: learning environment, teacher, and scaffolding tools. Reflective activities are described and implications for designing PBL discussed.

Introduction

Modern society is becoming more complex, information is becoming available and changing more rapidly prompting users to constantly re-think, switch directions, and change problem-solving strategies. Thus, it is increasingly important to help young students develop keen reflective thinking capabilities during learning that help them construct strategies for applying new knowledge to complex situations in their day-to-day activities. Reflective thinking helps learners develop higher-order thinking skills by prompting learners to a) relate new knowledge to prior understanding, b) think in both abstract and conceptual terms, c) apply specific strategies in novel tasks, and d) understand their own thinking and learning strategies (Hmelo & Ferrari, 1997). PBL provides learners with instructional mechanisms that can increase their reflective thinking while exploring authentic and ill-structured problems, participating in social interactions, and receiving coaching from peers and teachers (Albanese & Mitchell, 1993; Donahuse, 1999; Hmelo & Ferrari, 1997). This mindful stance toward learning is essential for efficient development of reflective thinking and ultimately knowledge construction. However, the research on factors that may affect reflection during PBL is limited.

Previous studies have sought to identify factors that influenced reflection by looking at the activities in which learners engage during the PBL process (van den Hurk, et al., 1999). These studies have identified factors that may encourage reflective thinking but it is still unclear which factors the learner feels prompts valuable reflection. Answering questions such as how do we support reflective thinking in a PBL environment requires identifying both the factors that might prompt reflective thinking and examining learner perceptions about those factors. Therefore, the purpose of this study was to identify factors that learners perceived as important in facilitating their own reflections during learning activities.

Examining research-based factors for prompting reflective thinking in a PBL environment would be helpful in several areas. First it would simplify the further analysis of factors prompting reflective thinking in PBL by reducing the number of variables. Second it would provide a meaningful and useful framework for discussing design factors that support learners' reflective thinking when participating in a PBL lesson in a classroom.

Theoretical Framework

What is reflective thinking? John Dewey introduced the concept "reflective thought." Dewey's most basic assumption was that learning improves to the degree that it arises out of the process of reflection. Dewey (1933) defined reflective thinking as "active, persistent, and careful consideration of a belief or supposed form of knowledge on the grounds that reflective thinking supports the belief or knowledge and the further conclusions one can draw about it. This cycle is determined by the production of changes one finds on the whole satisfactory or by the discovery of new features which give the situation new meaning and change the nature of questions to be explored".

Moon (1999) believed that reflective thinking is a chain of ideas that is aimed at a conclusion and is more than a stream of consciousness; whereas, Canning (1991) believed that reflective thinking was a behavior that involves active, persistent, and careful consideration of any belief or practice that promotes understanding of underlying beliefs and applying newly gained knowledge to new situations. These studies agree that reflective thinking includes the process of analyzing and making judgment about what has happened. Reflective thinking experiences are associated with increased motivation, willingness to take risks, enhanced self-esteem and independence.

Why is it important to support reflective thinking in a PBL lesson? We can find an answer in the characteristics of PBL. PBL provides an environment where learners encounter ill structured problem situations. In reality, PBL takes place in settings that are characterized by a great deal of ambiguity, complexity, variety, and conflicting values that make unique demands on the learner's skills and knowledge. As a result, learners in a PBL lesson are constantly making choices about the nature of practice problems and how to solve them. Learners must be able to change ill-defined practice situations into those in which they are more certain about the most appropriate course of action to pursue. Therefore, the ability to reflect while acting is necessary to maintain the essence of effective practice in a PBL lesson.

Prompting reflective thinking is especially important to young students because the students of this age are experiencing many developmental transits. Reflective thinking doesn't occur in middle-level students spontaneously. According to King and Kitchener (1994), reflective thinking has seven developmental stages. Reflective judgment is in the seventh stage and the term that they apply to the most advanced stage in their model. People in the seventh stage who have reflective judgment can acknowledge that there is no right answer and experts may disagree as to the best solution of a dilemma. King & Kitchener describe reflective judgment as similar to 'wisdom' that adults usually have. However, middle school students are in a different developmental stage than adults. The National Middle School Association reports that middle level students are in a transition period from concrete thinking to abstract thinking. Therefore, they need some supportive activities to prompt their reflection in order for them to make learning meaningful and active. Therefore, it is necessary to prompt reflective thinking for middle-level students who are in their concrete thinking stage.

How then, do we prompt middle school students' reflective thinking in a PBL lesson? Research suggests that various elements in PBL are related to prompting students' reflective thinking. Previous research indicates that tasks, teachers, instructional environments, and reflective thinking tools are key elements that support reflective thinking in PBL (Andrusyszyn, 1997; Lin, 1999; Moon, 199; Barrow, 1998). First, ill-structured, authentic, and complex tasks are known to promote reflective thinking. These features of the task help students think reflectively because they come from real-world experiences, have no single formula for conducting an investigation to resolve the problem, and require more information to understand the problem situation (Stepien & Pyke, 1997). Second, the role of teacher is important in prompting reflective thinking during PBL. According to Virtanen et al. (1999), both facilitating teachers and traditional teachers are effective in a PBL environment. A teacher who prefers facilitative activities may help learners by asking reflective questions while a traditional teacher explains or directs important reflective concepts to students (Moon, 1999; Virtanen et al, 1999). Third, flexible and active learning environments are also important in prompting reflective thinking during PBL. Effective PBL requires a relaxed atmosphere that can promote cooperative and collaborative learning and is conducive to students and teachers exploring misunderstandings together (Michale & Susan, 1998). Finally, the scaffolding tools are important in prompting reflective thinking during PBL. Andrusyszyn & Daive (1997) and Kinchin & Hay (2000) posit that there are three main types of tools that scaffold reflective thinking: reflective journals, guiding questions, and concept maps.

However, incorporating these factors into PBL may or may not enhance reflective thinking. Learners may perceive different factors in the environment as important in promoting their own reflection. Therefore, understanding how learners perceive the importance of each factor in prompting their thinking about their learning is important in designing effective PBL environments, which has, thereby, prompted the following research questions:

1. What are the factors that students perceive as prompting reflective thinking?
2. Which factor is perceived as the most important for prompting learners' reflective thinking?
3. Is there a significant difference between the derived factors?
4. Which elements or characteristics prompt reflective thinking within the derived factors?

Method

Subjects

One hundred and forty-four sixth through eighth grade students attending three different middle schools in rural Pennsylvania participated. Students were from 6 different classrooms; including 82 boys, 59 girls, and 3 who did not identify their gender.

Instrument

A survey questionnaire for measuring the perceived factors related to reflective thinking in PBL was designed by the authors based on the literature of reflective thinking. The instrument consisted of 10 items that were scored on a 5-point Likert scale from strongly agree (5) to strongly disagree (1). The survey was reviewed for content and face validity and then tested with a small sample of middle school children to establish readability. The Cronbach alpha reliability of the final survey was .890.

Data Source and Analysis

Quantitative data on the perception questions were collected prior to participation in Problem-based Learning lessons. Data were collected over a five-month period, between October 2000 and March 2001. Maximum likelihood extraction and varimax rotation method were conducted for the factor analysis, using the SPSS/PC+ statistical package.

Results

In response to the first research question, *what are the factors that students perceive as prompting reflective thinking*; three factors emerged from the data based using an Eigen value of 1.0. Based on the literature review about design attributes required for reflective thinking, these findings were encouraging. (See Table 1.) Three items (teacher explanation, teacher question, and authentic task) were in the same factor 1, five items (having freedom in class, working with a partner, working with an ill-structured task, having time to think, and drawing pictures) were in the same factor 2, and two items (answering questions and writing about my understanding) clustered in the same factor 3. The main characteristics of factor 1 appear to relate to the teacher variable, those of factor 2 appear to relate to the student learning environmental variable, and those of factor 3 appear to relate to the tool variable for prompting reflective thinking

Table 1. Factor loading of elements that prompt reflective thinking in PBL

Item	Item content	**Factor 1**	**Factor 2**	**Factor 3**
3	When my teacher explains how to solve difficult tasks it helps me think more about what I am studying.	**.909**	.104	.217
4	When my teacher asks me how to solve difficult tasks it helps me think more about what I am studying.	**.566**	.297	.398
2	Working on activities in class related to real problems on earth or in our society helps me think more about what I am studying.	**.388**	.385	.208
7	Having freedom in class to explore topics I am interested in helps me think more about what I am studying.	.181	**.600**	
5	Working with partners during classroom activities helps me think more about what I am studying.	.122	**.491**	
1	Working on activities in class that have many different answers helps me think more about what I am studying.	.247	**.475**	.360
6	Having time to think about a question before answering helps me think more about what I am studying.	.428	**.460**	.116
8	Drawing pictures to illustrate my understanding of a topic helps me think more about what I am studying.		**.451**	.225
10	Answering questions about a topic helps me think more about what I am studying.	.172	.137	**.782**
9	Writing about my understanding of a topic helps me think more about what I am studying.	.182		**.600**

In response to the second and third research questions, *which factor is perceived as the most important for prompting learners' reflective thinking and is there a significant difference between the derived factors*, the highest ranked factor mean was the student learning environment factor (Factor 2, M= 3.87), followed by the teacher factor (factor 1, M= 3.62) and tool factor (Factor 3, M= 3.21). See Table 2. A paired sample t-test analysis was carried out to compare the factor means scores in three factor groups. The paired sample t-tests indicated that there were significant differences between the factors. The mean score of factor 2 is significantly higher than that of factor 1 or factor 3 ($p < .01$). The mean score at factor 1 is also significantly higher than that of factor 3 ($p < .01$). This result shows that students perceive the student learning environment factor (factor 2) as the most significant factor to help think reflectively. The student learning environment factor included student-centered attributes such as more flexible atmosphere, time, and tasks, peer tutoring activities, and bursts of activities incorporating a drawing. Therefore students perceive a student-centered learning environment as prompting more reflective thinking than a teacher-centered environment that provides questions and explanations from teachers or a simple supportive learning environment that includes reflective thinking tools such as questions or writing.

In response to the fourth research question, *what elements or characteristics prompt reflective thinking within the derived factors*, the highest ranked elements, both of a social nature and loaded to factor 2, were having freedom to explore topics in class (x= 4.10) and working with partners (x= 4.05). See table 3.

Table 2. Paired samples t-test for factors

	Mean	**Std. Deviation**	**t**	**df**	**Sig (2-tailed)**
F1	3.62	.80	-4.209	140	.000
F2	3.87	.62			
F2	3.87	.61	8.471	142	.000
F3	3.21	.92			
F1	3.62	.80	5.243	140	.000
F3	3.21	.93			

Table 3. Mean and standard deviation of question lists

Item	Item content	Mean	SD
1	Working on activities in class that have many different answers helps me think more about what I am studying.	3.706	.93
2	Working on activities in class related to real problems on earth or in our society helps me think more about what I am studying.	3.63	.99
3	When my teacher explains how to solve difficult tasks it helps me think more about what I am studying.	3.71	.90
4	When my teacher asks me how to solve difficult tasks it helps me think more about what I am studying.	3.52	1.03
5	Working with partners during classroom activities helps me think more about what I am studying.	4.05	.94
6	Having time to think about a question before answering helps me think more about what I am studying.	3.90	.82
7	Having freedom in class to explore topics I am interested in helps me think more about what I am studying.	4.10	.94
8	Drawing pictures to illustrate my understanding of a topic helps me think more about what I am studying.	3.59	1.07
9	Writing about my understanding of a topic helps me think more about what I am studying.	2.94	1.13
10	Answering questions about a topic helps me think more about what I am studying.	3.48	.99

Conclusions, Limitations, and Importance to Instructional Design

Students perceived three major factors as most important in prompting their reflective thinking; student learning environment, teacher, and tools, ranked respectively. Of further importance was that the social activities within the environment were ranked as most important, demonstrating the importance of social learning to students. Previous research on the collaborative learning activities support the importance of social learning (Koschman, Kelson, Feltovich, & Barrows, 1996). Although the kids "liked" the collaborative activities, their teachers found them to be inexperienced in group decision-making and collaborative learning. Further research is needed to investigate how to scaffold students for successful participating in collaborative activities.

Further research is also needed to examine how these three factors, student learning environment, teacher, and tools, interact with each other. Given that the student learning environment emerged as the most important factor, it is important to further refine and test the attributes of this factor. This process will help to determine whether there are other specific components in the learning environment that student perceive as prompting their reflective thinking.

The findings of this study have important implications on the design of problem-based learning environment so that they will prompt reflective thinking. Student-centered environments that have a more flexible atmosphere, and provide many venues for social learning may have a stronger impact on learner's perception on reflective thinking. This research raised implications about students' perceptions of factors that prompt their thinking and learning. Designing PBL that prompts reflective thinking and ultimately deeper learning can be achieved by better understanding learner perceptions about factors that prompt their reflective thinking.

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Older Adults Eager to Explore Cyberspace

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Abstract

This study compared two methods of computer instruction for older adults. Elder Computer Instruction was systematically designed and developed according to criteria established by both theory and research in andragogy. This instructional design took into consideration identified cognitive and physical changes that accompany the aging process. Traditional Computer Instruction consisted of generic computer instruction commonly used with adults of all ages. A checklist, the Criteria Checklist for Andragogical Principles, was developed to help instructional designers and educators assess the adherence of instructional materials to andragogical principles. The systematic process for instructional design detailed in the study should be of use to those involved in the design, development, and delivery of instruction for older adults. The study investigated the effects of both types of instruction on older adults' computer attitudes, frequency of computer use, and types of computer tasks performed. Participants in both groups completed the Attitudes Toward Computers Questionnaire that assessed six dimensions of attitudes toward computers. Participants receiving Elder Computer Instruction had significantly more positive attitudes in the dimensions of efficacy, interest, and utility. The Computer Task Frequency Survey was given as a pretest/posttest. Both groups increased in their frequency of computer use and types of computer tasks performed following instruction. There was a significant difference between the two groups in the e-mail task, with those who received Elder Computer Instruction sending more e-mail than those who received Traditional Computer Instruction. This study underlines the importance of designing instruction to meet the specialized learning needs of older adults.

Older Adults Eager to Explore Cyberspace

As people age, once-active adults often find their world gradually shrinking as they become less mobile due to physical impairments that affect walking and driving (Coughlin, 1999). The Internet, however, offers older adults new opportunities for communication and car-less access to religious services, cultural activities, and educational opportunities (Whelen, 1998). According to Czaja and Sharit (1998), if older adults are successful in acquiring basic computer skills, they will realize that their daily lives can be enhanced and enlivened by using technology. Because most older adults did not learn to use computers in school (Dunnett, 1998), or in the workplace, those who now want to use them must find sources for instruction.

Computer use among older adults is increasing rapidly. According to the U. S. Census Bureau (2000), 27.6% of adults over the age of 55 live in a home with Internet access. A survey by International Data Corporation reports that adults over the age of 55 account for more than 12 million Internet users, an increase of 106% over users in the same age group in 1999. By 2004, this age group is expected to comprise 20% of all new Internet users (Hoffman, 2000).

Although computers are becoming less expensive and easier to use, older adults still face the problem of acquiring basic computer skills. Morrell, Mayhorn, and Bennett (2000) surveyed 115 Web users and 266 Web nonusers between the ages of 40-92. More than 81% of the Web users reported that they had taught themselves to use the Web. The two primary reasons given by the nonusers for not using the Web were the lack of computer access and lack of knowledge about using the Web. Both groups indicated that they would like to have simple instructional materials to show them how to use the different features of the Web. Morrell and Echt (1997) point out that older adults who are interested in learning about computers often have to search for training opportunities or have to teach themselves to use computers. The instructional materials they use are often designed for much younger people.

Research indicates that adults learn best when the learning goal is articulated clearly and when they can apply their learning to real-life problems (Redding, Eisenman, & Rugolo, 1998). The necessity for taking into account the learner's readiness to learn, life experiences, self-direction, intrinsic motivation, and problem-solving ability, as well as the immediate value to the learner, forms the basis of the adult learning theory known as andragogy. One of the strengths of this theory is its adaptability to the uniqueness of learners and to various learning situations. Because the principles of andragogy can be applied to a variety of adult learning situations (Knowles, Holton, & Swanson, 1998), it is an ideal conceptual framework on which to base computer instruction.

The practice of teaching adults could be said to have begun with philosophers and religious leaders such as Confucius, Socrates, Plato, and Jesus. It was not, however, until the second half of the twentieth century that Malcolm Knowles integrated various adult teaching methods into an adult learning theory that is now called andragogy. Knowles (1990) found that andragogy was especially pertinent to computer instruction. He points out four characteristics of adult learners that should inform the design of computer instruction for adults. First, because adults have a deep need to know why they should learn something before they invest their time and energy, computer instructors should explain the purpose of specific computer functions. Next, instructors should start with adult learners' interests because adults learn best those things that they must know in order to perform tasks that are relevant to them. Instructors should ask learners to write their personal goal for computer use. Third, the instructor should find out the background experiences of the learners in order to give them choices based on their prior experiences. Instructors should administer a pretest survey to determine the computer tasks the learners have performed prior to the instruction. Finally, adults are self-directing and dislike having decisions imposed on them. For this reason, teachers should allow adults to figure things out for themselves. Teachers who become facilitators rather than directors of learning create a nurturing learning environment.

Researchers such as Czaja and Sharit (1998) and Jay and Willis (1992) found that experience with computers increases older adults' feelings of comfort with technology, competence with computers, and feelings that computers are useful. Redding, Eisenman, and Rugolo (1998) note that adults learn best when the learning goal is articulated clearly and when they can apply their learning to real-life problems.

In addition to the characteristics of the individual adult learner, the effects of group experience are also relevant. Because learning is a social practice (Knights, 1993), the communal dimension of learning should not be undervalued. Knights points out that groups can exert a powerful influence to advance learning. Dixon and Gould (1996) found that when older adults collaborated with others in a problem-solving situation, their cognitive performance was enhanced. According to Cahoon (1996), when members of a group learn computer skills together, they can share their skills and knowledge as they solve computer problems through informal interactions with other group members.

Statement of the Problem

As America's population ages, it has become increasingly important that older adults have access to computer instruction that will enable them to feel more included in our technological society (Morris, 1994). Furthermore, computer instruction should be designed specifically to meet their needs. This study focused on the need to design instructional materials and to develop both instructional and grouping strategies that were theoretically grounded in the principles of andragogy. This instruction took into consideration identified cognitive and physical changes associated with aging. These changes include changes in vision, hearing loss (White et al., 1999), and decline in working memory, which is the process of storing information that is necessary in order to perform certain cognitive tasks (Salthouse & Babcock, 1991).

Purpose of the Study

This study focused on the systematic design, development, implementation, and evaluation of instruction to address the needs of older adults. The purpose of this study was to compare two methods of computer instruction for older adults. The study investigated the effects of both types of instruction on older adults' computer attitudes, frequency of computer use, and types of computer tasks performed. In addition, the study considered the effects of grouping on the computer attitudes of older adults.

Elder Computer Instruction

A needs assessment was conducted among a representative group of 54 older adults (Lawton, 1999). The results indicated that this population perceived themselves to have the greatest performance discrepancy with regard to computer competencies when they compared themselves to other age groups. Next, computer instruction for older adults was designed. The instructional materials were tested in a field trial and then refined and revised based on feedback from participants in a posttest survey and a focus group.

Elder Computer Instruction was systematically designed computer instruction. It was based on criteria established from both theory and research in andragogy and cognition and was developed using a process called instructional systems design. According to Seels and Richey (1994), instructional systems design is an organized procedure that includes the steps of analyzing, designing, developing, implementing and evaluating instruction. Analyzing is the process of defining what is to be learned; developing is the process of authoring and producing the instructional materials; implementing is actually using the materials and strategies in context, and evaluating is the process of determining the adequacy of the instruction. The Dick and Carey (1996) model was chosen as the instructional design framework because it provides a strong, fundamental process of instructional design that incorporates learning theory research and practical application. The strength of this model, which provides a step-by-step process to design instruction, is that all design components work together systematically to produce effective instruction and evaluation. The components of a learning system are made up of the learners, the instructor, the instructional materials, and the learning environment. The focus of a systematic instructional design is on what the learner is to know at the conclusion of the instruction (Dick & Carey). Design decisions based on data are particularly important in this model, thus the emphasis on needs assessment, formative evaluation and field trials.

Traditional Computer Instruction

Traditional Computer Instruction is generic computer instruction commonly used with adults of all ages. It was not specifically designed for older adults. Lectures were used to teach the history of computers, the purposes of computer systems, the functions of computer hardware, the importance of a comfortable working environment, and the use of computer terminology. Hands-on activities, beginning with lower level skills, were used. Activities were modeled, but in some instances learners were not given time to practice the activity. The computer manual contained the same information as the lecture and was uniform for all adult age groups. Most of the instructions were given orally. No memory aids in the form of written step-by-step directions were provided. Learners were instructed to use the "help" function on the task bar if they forgot a computer application.

The two instructional methods compared in this study shared the same terminal goal, that of enabling older adults to develop basic computer skills. The differences in both the instructional content and the teaching strategies in the two methods, however, were considerable.

Methodology

A quasi-experimental design was chosen as the framework for this empirical study. According to Huck and Cormier (1996), the most frequently used quasi-experimental design is the nonequivalent control group design. The group using Elder Computer Instruction was the treatment group; the group using Traditional Computer Instruction served as the comparison (control group). This study utilized the nonequivalent control group design because of the availability of pretest data and the fact that participants were not randomly assigned to the comparison group.

Instructional Environment

The six computer workshops for the treatment group (Elder Computer Instruction) were held in the same computer lab located in the Educational Technology Training Center at a local university. Each workshop was conducted on a Saturday from 9:00 a.m. until 3:00 p.m. with an hour for lunch. In addition, a morning and an afternoon break were included in the schedule. Participants were encouraged to take any extra breaks that were necessary. Every effort was made to ensure that participants were comfortable. In addition to the instructor, at least two facilitators were present in each workshop to provide individual instruction and to answer participants' questions. Participants were encouraged to ask questions at any time during the instruction. The lab was well lighted with adequate space and was furnished with adjustable chairs on rollers. Although the 17 computers in the lab were located in close proximity, there was enough space at each workstation for participants to work comfortably. Computers were networked to one printer and equipped with Windows 2000. All computers had Internet access. The lab also contained a teaching station and a smart-board projection system. Each participant was provided with a computer manual and a diskette.

The comparison group (Traditional Computer Instruction) attended computer classes held in a computer lab at a local technical college. The class met for two hours on Tuesdays and Thursdays for two weeks. Total instructional time was eight hours. The computer lab at the technical college was spacious and well lighted. The 18 computers in the lab were located on wide tables, and the adjustable chairs were equipped with rollers. A white board at the front of the room was provided for the instructor's use. The lab contained a teaching computer that could be projected onto the screen at the front of the room. The computers were networked to one printer and equipped with Windows 2000. The computers did not have Internet access. The instructor provided both group and individual assistance, as there were no facilitators to assist in the instruction. Each participant was provided with a computer manual and a diskette.

Participants

The 93 participants in this study consisted of older adults who ranged in age from 55 to 85 years of age with a mean age of 68.4 years. There were 25 males and 68 females. Participants were divided into three groups: an existing group, a newly formed group, and a comparison group. Thirty-seven participants were volunteers who were members of three different existing groups. Two groups were from area churches, and one group consisted of a sorority for professional women. This group consisted of 9 males and 28 females with a mean age of 69.1 years. Twenty-seven were Caucasian and 10 were African-American. These participants were previously acquainted and shared commonalities.

There were 45 participants in the newly formed groups. They were acquainted with few, if any of the other participants prior to the computer workshop. These participants were recruited from advertisements in the newspaper, fliers in area grocery stores, advertisements in senior centers, advertisements at a local hospital that provides senior activities, and word-of-mouth referrals. This group consisted of 12 males and 33 females with a mean age of 67.8 years. Thirty-five were Caucasian and 10 were African-American.

The participants in the comparison group began with four males and eight females. One female dropped out after the second session. The remaining participants had a mean age of 68.6 years. All were Caucasian. These participants were enrolled in a basic computer class through a continuing education program at a local technical college. All volunteered to take part in the study. The number of participants was determined by course registration with the intent to compare groups of approximately equal size.

Instructional materials designed for this study were compiled in a computer manual entitled Seniors Surf Into the Twenty-first Century. These materials, first used in a field trial, were developed following the model in The Systematic Design of Instruction (Dick & Carey, 1996). This development process included formative and summative evaluation that was used to revise the instructional materials, making them more efficient and effective. A checklist, the Criteria Checklist for Andragogical Principles (Lawton, 2001), was also designed to assess the adherence of instructional materials to the principles of andragogy (Caffarella, 1993; Cross, 1981; Knowles et al., 1998; Pratt, 1993). This yes/no checklist asks evaluators to assess three major components of instructional design: instructional strategies, design of instructional materials, and design of the physical learning environment. Evaluators then cite evidence and/or concerns for the application of each principle in the space provided on the checklist.

Data Collection

Quantitative data for this study were collected in the following ways. At the beginning of the instruction,participants for both the treatment group and the comparison group were given the Background Demographic Survey. Learners were given the Computer Task Frequency Survey (Lawton, 2001) as a pretest/posttest to determine differences in computer frequency and types of tasks performed between the groups. Although there were differences in the administration of the pretest (which was print) and the posttest done via phone eight weeks following the instruction, the administration was the same for both the treatment group and the comparison group. Participants in both the treatment group and the comparison group completed the Attitudes Toward Computers Questionnaire (ATCQ; Jay & Willis, 1992). This 33-item multidimensional measure assesses six dimensions of attitudes toward computers: comfort, efficacy, control, dehumanization, interest, and utility. Each of these dimensions is assessed by five or six items on a 5-point Likert scale format. A seventh dimension, gender equality, was not used in the present study. Response options range from "strongly disagree" to "strongly agree." The ATCQ has been used in prior research with older adults (Czaja & Sharit, 1998; Jay & Willis, 1992).

Data Analysis

Data gathered through the Computer Task Frequency Survey and the Attitudes Toward Computers Questionnaire were analyzed by a one-way analysis of variance. The purpose of the analysis was to determine whether or not there were significant differences at the $p \leq .05$ level in attitudes toward computers and types and frequency of computer tasks performed between the treatment and comparison groups.

Significant differences were found between the treatment group and the comparison group with the treatment group performing higher on three of the six dimensions: efficacy, interest, and utility. In the dimension efficacy, differences were statistically significant, $F\ (1,92) = 6.204$, $p = .015$. Analysis of the interest dimension revealed a statistically significant difference, $F\ (1,92) = 7.904$, $p = .006$. The dimension utility also had a statistically significant difference, $F\ (1,92) = 5.534$, $p = .021$. Analysis of the dimensions of comfort, control, and dehumanization did not reveal a statistically significant difference between the two groups.

When the attitudes of the participants in the existing groups and the newly formed groups (both of these groups received Elder Computer Instruction) were compared, there were no significant differences found. A comparison of the computer attitude of participants receiving Elder Computer Instruction according to age--the young-olds (ages 55-64) and the older-olds (65+)--revealed no significant differences in attitudes.

Two questions measured the frequency of computer use. Participants were asked how many times they had used a computer for any reason and how many hours per week they used a computer. While each group increased their frequency of use from the pretest to the posttest, the differences between the two instructional groups were not statistically significant.

The other nine questions measured the different types of computer tasks participants performed: using the mouse, changing the speed or size of the mouse pointer, moving desktop icons, playing solitaire, saving a document to a disk, sending e-mail, opening e-mail, sending an e-mail attachment, and using the Internet.

Analysis of the e-mail computer task revealed a statistically significant difference, $F\ (1,92) = 6.067$, $p = .016$, between the treatment group and the comparison group. Participants in the treatment group sent e-mail more frequently than did those in the comparison group. There was no statistically significant difference between the two groups in the other types of computer tasks performed.

Discussion

Results of data analysis support the benefits of systematically designed computer instruction for older adults. The findings indicate that the treatment group receiving Elder Computer Instruction demonstrated more positive attitudes on every attitude dimension than did those receiving Traditional Computer Instruction. In three of the six attitude dimensions, there were significant differences between the two groups. These three dimensions--efficacy, interest, and utility--have a direct relationship to the theory of andragogy. The participants receiving Elder Computer Instruction evidenced a significantly more positive attitude in the area of efficacy. According to the theory of andragogy, adults learn best when they are motivated to learn. They believe that they can learn new material (Knowles, et al., 1998). Elder Computer Instruction participants also evidenced significantly more positive attitudes in the area of interest. Another adult learning principle (Knowles,1990) is that adults are interested in learning what they need to know to perform a task. Finally, data analysis revealed a significantly more positive attitude in the dimension utility for participants receiving Elder Computer Instruction. The core principle of andragogy is that adults need to know why they should learn something before they engage in learning (Knowles et al., 1998). When adults realize how computers can enrich and enliven their lives, they will understand the usefulness of learning computer skills. The participants receiving Elder Computer Instruction appeared to have a greater appreciation of the usefulness of computers.

Conclusions

The distinguishing feature of this study is its focus on the importance and benefits of systematically designing computer instruction for older adults. The statistically significant differences found in attitudes were between the groups receiving different instruction. Neither group membership nor age appeared to have an effect on computer attitudes. The type of instructional method received by the participants appears to be a more important factor in shaping computer attitudes. It was observed during the instruction that members of newly formed groups receiving Elder Computer Instruction evidenced interaction and collaboration with other participants similar to that observed in the existing groups who were previously acquainted. Many participants who were not previously acquainted worked together to perform computer tasks. Participants who learned tasks quickly often checked to be sure that slower participants kept up with the instruction. During the e-mail activity, many exchanged e-mail addresses and e-mailed each other. New acquaintances chatted with each other during breaks and often went to lunch together. With the exception of two married couples, participants receiving Traditional Computer Instruction were not previously acquainted. These participants also worked together to perform computer tasks, helped each other with tasks, and became acquainted with each other during the instruction.

Knights (1993) notes that learning is a social practice, and group members often are concerned for each other. Findings suggest that older adults appear to be more aware of the advantages of collaboration and are often more willing to interact with others for assistance or support in learning a task than are younger learners (Dixon & Gould, 1996; Kazemek, 1997). It may be that when older adults have a shared sense of purpose such as learning computer skills, previous group affiliation becomes less important. Prior research also indicates that older adults often feel at a disadvantage when learning computer skills in a fast-paced class with younger learners (Dunnett, 1998; Redding et al., 1998; Timmerman, 1998). Both Elder Computer Instruction and Traditional Computer Instruction were limited to adults, ages 55 and above. Adults in both existing groups and newly formed groups expressed that they preferred computer classes made up of older adults.

This study describes the step-by-step process used to design instructional materials according to learning theory research and practical application. The research also provides new information regarding the relationship between the instructional materials used for older adults and their resulting attitudes toward computer use. When older adults receive computer instruction that is designed uniquely for their needs, they appear to develop more positive attitudes toward computers.

At the conclusion of one of the workshops in which the participants were members of an existing group, one participant confessed that she had once walked out of a computer workshop. "The instructor gave a detailed lecture on the inner workings of the computer. I went to the workshop to learn how to use the computer. I really did not care how it worked, so I left. I stayed for this entire workshop because it was practical. Now I believe that I can use a computer."

JoAnn, another participant, came to the workshop to learn to e-mail. She had traveled in China and discovered that she could have e-mailed her family from public computers at a nominal cost had she known how to set up a hotmail account. After the workshop, she traveled in Europe. She reported that not only had she used the hotmail account that she learned to set up during the class, she had taken her computer manual with her and taught a fellow traveler how to use e-mail.

Monira, originally from Lebanon, owned a computer prior to the workshop and regularly exchanged e-mail with her family in Lebanon. However, she had to wait for a relative or friend to come to her house and open her e-mail so that she could read it, and then send her responses for her. At the workshop, she learned to e-mail independently.

Loretta, another participant, told about her experiences in teaching English to a woman who had recently moved to the United States from South America. In addition to learning English, the woman wanted to learn basic computer skills in order to e-mail her family in South America. Loretta gave her a copy of the manual used in the workshop. Because it was written clearly and simply, a person with limited English could use it successfully.

One of the basic principles of andragogy is that adults learn best those things that they must know in order to perform tasks that are relevant to them (Knowles, 1990). At the beginning of one work shop, an 80-year-old participant confided that her grandchildren had asked, “Grandma, what’s wrong with you? You can’t e-mail.” On the posttest survey eight weeks after the instruction, she reported that she was now e-mailing her grandchildren.

Since this study was the first to compare systematically designed computer instruction for older adults with more generic computer instruction commonly used with older adults, it provides ample opportunity for further research. There are still many older adults who need access to training facilities (Galusha, 1998). All interested older adults need the opportunity to explore the world afforded them by technology--not the least to facilitate those e-mails to their grandchildren.

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Online Students' Perceived Self-Efficacy: Does It Change?

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Abstract

Two types of self-efficacy were investigated in this study: self-efficacy for course content and self-efficacy for online learning technologies. Specifically, we examined how these two types of self-efficacy change throughout a semester. Secondly, we examined whether students' self-efficacy is predictive of their satisfaction and course performance. Three hypotheses were tested: (a) self-efficacy for both course content and online learning technologies change across a semester; (b) self-efficacy is predictive of student satisfaction with course; (c) self-efficacy is predictive of course performance. Participants were undergraduate students who enrolled in an online course at the University of Central Florida. In an attempt to longitudinally gauge the student's continuing self-efficacy, a self-efficacy survey for the course content and online learning technologies was administered every three weeks (four times across a semester). At the end of the semester, students' perceived degree of satisfaction with the online course was measured and students' final course scores were obtained from the instructor. Results indicated that both self-efficacy for course content and self-efficacy for online technologies increased during the semester. In addition, while initial self-efficacy for course content was a significant predictor ($p<0.05$) of students' satisfaction with the course, neither self-efficacy with course content nor self-efficacy with online technologies was significant predictors of performance.

Introduction

The development of telecommunications technology since the early 90's has led to an explosive growth in the World-Wide Web (WWW). According to the Ipsos-Reid (2001) and CyberAtlas's (2001) reports, as many as 400 million people are already on the Internet, and nearly one billion people (about 15% of the world's population) will be connected to the Internet by 2005. Along with the astonishing growth of Internet usage, an increasing number of educational institutions are now offering their courses via the Web, namely Web-based (online) education. International WHERE + HOW (2001) lists more than 55,000 online courses that are provided by higher educational institutions and training corporations. The benefits of online education are two-fold: individuals are given an opportunity to enhance their professional development and expand career opportunities while juggling responsibilities between family and work, and online education provides educational institutions a means to reach a greater student population resulting in an increase in revenue.

Although online education is gaining tremendous popularity, it is accompanied with a serious problem: a high attrition rate. Students enrolled in distance courses are more likely to drop out than their traditional counterparts. According to Moore and Kearsley (1996), the attrition rate in distance education courses is between 30 and 50%, which is much higher than in traditional course settings. This results in some negative implications for students, as well as for institutions. For students, the negative effects of dropout include loss of opportunity for personal and career advancement, lowered self-esteem, and increased likelihood of future disappointment (Atman, Egan, Sebastian, Welch, & Page, 1991). For an institution, high attrition rate results in considerable financial loss (Keegan, 1986).

Background of the Study

A great deal of research has been conducted to investigate factors that lead to student attrition (Baynton, 1992; Coggins, 1988; Dille & Mezack, 1991; Eisenberg & Dowsett, 1990; Fjortoft, 1995; Frew & Weber, 1995; Garland, 1993; Keller, 1999; Miltiadou, 2000; Parker, 1995; Pugliese, 1994; Zajkowski, 1993). Among those factors identified, motivation is often considered a strong predictor of success in a distance course (Baynton, 1992; Coggins, 1988; Dille & Mezack, 1991; Fjortoft, 1995; Garland, 1993; Keller, 1999; Miltiadou, 2000; Zajkowski, 1993). Keller (1999) directly attributes attrition to a motivational problem.

While learning takes place at a distance, student motivation becomes particularly critical because distance learning places the responsibility of learning on the student much more so than does traditional learning. Cropley and Kahl (1983) stated:

> "distance learners are thrown back upon their own motivational resources to a greater extent than is the case with face-to-face learners, since many of the factors which provide external motivation are absent or present only in an indirect form in distance education. Internal motivation is a highly desirable thing in face-to-face education, but is a necessary precondition in distance education" (p.32).

In numerous studies of learning motivation, self-efficacy has been identified as a significant predictor of student motivation (Bandura, 1997). Specifically, self-efficacy is predictive of academic performance and course satisfaction in traditional face-to-face classrooms (Bandura, 1997) and online courses (Miltiadou, 2000; Wang & Newlin, in press). Furthermore, an individual's self-efficacy has a significant impact on his or her (a) actual performance (Locke, Frederick, Lee, & Bobko, 1984; Schunk, 1981); (b) emotions (Bandura, Adams, & Beyer, 1977; Stumpf, Brief, & Hartman, 1987); (c) choices of behavior (Betz &

Hackett, 1981); and (d) amount of effort and perseverance expended on an activity (Brown & Inouye, 1978). Self-efficacy, as defined by Bandura (1997) is, "the beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). According to Bandura (1997), four major sources contribute to an individual's self-efficacy: enactive experiences, vicarious experiences, verbal persuasion, and physiological indexes. Bandura (1982) reviewed a variety of self-efficacy studies in various settings, and found that self-efficacy theory has significant explanatory potential. He found that perceived self-efficacy accounts for a wide variety of people's behaviors, including changes in coping behavior produced by different modes of influence, levels of physiological stress reactions, self-regulation, achievement strivings, growth of intrinsic interest, and choice of career pursuits. Similarly, Multon et al. (1991), in a meta-analytic review of thirty-nine educational studies, found that self-efficacy beliefs were positively related to student persistence and academic performance across a variety of subject areas, experimental designs, and grade-level. Bandura (1997) also found that self-efficacious students share similar characteristics: they participate more readily, work harder, persist longer, and have fewer adverse emotional reactions when they encounter difficulties than do those who doubt their capabilities. This led Bandura to conclude that it is one thing for an individual to possess the necessary knowledge and skills to perform a task, and quite another to embody the self-beliefs in continuing with the task at hand while facing obstacles.

In light of the research, it is legitimate to infer that, in order to be motivated and successful in an online course, students should possess high self-efficacy for the content taught. However, if examined carefully, having adequate self-efficacy for course content might not be enough to succeed in an online course. Students with high self-efficacy for course content might not feel confident in learning in the online educational environment. Participation in online learning requires the extensive use of online technologies. To succeed in such courses, students should be able to use technologies to access course materials, send and receive email, browse the Internet, and perform searches to locate information. Students with limited or inadequate computer experiences or skills do not feel efficacious enough to participate in online learning and this can lead to computer anxiety (Loyd & Gressard, 1984). While students are experiencing computer anxiety, more effort is expended learning the media rather than the subject matter (Davie & Wells, 1991). Consequently, if an individual is to be efficacious about learning in an online course, he or she should possess two types of self-efficacy. One is self-efficacy for course content and the other is self-efficacy for online technologies. Online students should not only feel efficacious about the course content, but they should also feel efficacious in using online technologies.

Currently relatively few studies have been conducted to investigate self-efficacy and its relationship to satisfaction and performance when learning takes place in the online learning environment (Miltiadou, 2000; Wang & Newline, in press). And, results from those earlier studies concerning the effects of online technologies self-efficacy are inconclusive. Online technologies self-efficacy was negatively related to student performance in Miltiadou's (2000) study, whereas it was positively related in Wang and Newline's study (in press). In addition, those studies measured self-efficacy only one time - at the beginning of a semester. However, self-efficacy, especially self-efficacy with online technologies, may fluctuate during the course of a semester. Previous research on computer self-efficacy has indicated that positive past experience with computers increases computer self-efficacy beliefs while negative experience with computers lowers computer self-efficacy beliefs (Ertmer, Everbeck, Cennamo, & Lehman, 1994; Hill, Smith, & Mann, 1987; Torkzadeh & Koufteros, 1994). Similarly, in a web-based course, students' success or failure mastering online technologies contributes to the fluctuation of their efficacy expectation. Because self-efficacy regarding online technologies can fluctuate through the semester, measuring self-efficacy one time can reduce the accuracy of predicting the impact of self-efficacy on student learning.

Purpose of the Study

In an effort to provide an in-depth understanding of student's self-efficacy and its effects on student satisfaction and performance, this study examined (1) whether students' self-efficacy regarding course content and online technologies change throughout a semester; (2) whether self-efficacy for course content and online technologies are predictive of student satisfaction and performance. Specifically, answers to the following questions were sought:

1. Does a student's self-efficacy for course content change across a semester?
2. Does a student's self-efficacy for online technologies change across a semester?
3. Does self-efficacy of course content and online technologies serve as a significant predictor of student satisfaction and performance within a web-based course?

Methods

Participants

A total of sixteen students attending the University of Central Florida (UCF) at Orlando participated in this study. These students were enrolled in an undergraduate course, Introduction to Educational Technology (EME 2040). This course was offered through WebCT (WebCT is the course management tool used at the University of Central Florida).

Instruments

- Self-Efficacy Instrument

  The Self-Efficacy Instrument measures two components of self-efficacy beliefs – self-efficacy for course content and self-efficacy for online technologies. A total of 27, 5-point Likert-scaled items were developed. The first three items measuring course content self-efficacy were generated based on Eccles and Wigfield's (1995) 7-point Likert-scaled items. The last 24 items measuring online technologies self-efficacy were developed based on Miltiadou and Yu's (in press) Online Technologies Self-efficacy Scale (OTSES). Each statement is preceded by the phrase "I feel confident…" For each item, students are asked to indicate their attitude from "Strongly Disagree", "Disagree", "Neural", "Agree", to "Strongly Agree."

The instrument was tested by a pilot study conducted with thirty-two students during Spring 2001. Reliability analysis (Cronbach's coefficient alpha) showed that the reliability was .87 for the first three items measuring content self-efficacy and .90 for the rest 24 items measuring online technologies self-efficacy.

- Student Satisfaction Instrument

  In this study, student satisfaction with the course was measured by an attitude questionnaire that was administered during the last week of Summer 2001. This satisfaction instrument consists of 19 items measuring students' self-r reported level of satisfaction with the online course. Specifically, the attitudes instrument measured students' self-reported level of satisfaction with the course materials, instructor, and the online technologies. For each item, students were asked to indicate their attitude from "Strongly Disagree", "Disagree", "Neural", "Agree", to "Strongly Agree." In a pilot study conducted with thirty-two students during Spring 2001, reliability analysis (Cronbach's coefficient alpha) indicated that the reliability was .93 for these 19 items in this instrument.

Procedures

Participating students were asked to take an online survey (Self-Efficacy Instrument) at four intervals during the course of the Summer 2001 semester. Every three weeks, students were asked to fill out an online survey measuring their course content self-efficacy and online technologies self-efficacy. Along with the fourth survey (the last survey), a satisfaction survey (Student Satisfaction Instrument) was administered to measure student's degree of satisfaction with this online course. In addition, with students' permission, their final course scores were obtained from their course instructor.

Two statistical analyses were employed in this study. First, a doubly multivariate repeated measures analysis of variance was used to examine whether self-efficacy for both course content and online learning technologies changed across a semester. Second, multiple linear regression was used to determine if course content self-efficacy and online technologies self-efficacy could predict satisfaction and performance.

Results and Discussion

The results of this study showed that there is a statistically significant change ($F_{6, 10} = 4.4$, $p = .02$) in self-efficacy for course content and self-efficacy for online technologies during the semester. Almost 73% (72.5%) of the change in combined self-efficacy can be accounted for by the time interval. Both self-efficacy for online technologies ($F_{3, 45} = 7.72$, $p < .01$) and self-efficacy for course content ($F_{3, 45} = 5.06$, $p < .01$) changed over time. Within subjects contrasts showed that self-efficacy for online technologies increased significantly ($F_{1, 15} = 5.64$, $p = .03$) during the first three weeks of the semester (between time 1 and time 2). Although the respondents' confidence level with online technologies increased after the second time, neither the increase from the second time to the third time nor the increase from the third time to the fourth time was statistically significant ($p<0.05$). On the other hand, within subjects contrasts using self-efficacy for course content showed a non-significant decrease ($p>.05$) from time 1 to time 2, a statistically significant increase from time 2 to time 3 ($F_{1, 15} = 5.4$, $p = .04$) and a statistically significant increase from time 3 to time 4 ($F_{1, 15} = 6.67$, $p = .02$). These results are displayed in Figures 1 and 2.

Figure 1
Self-Efficacy for Online Technologies

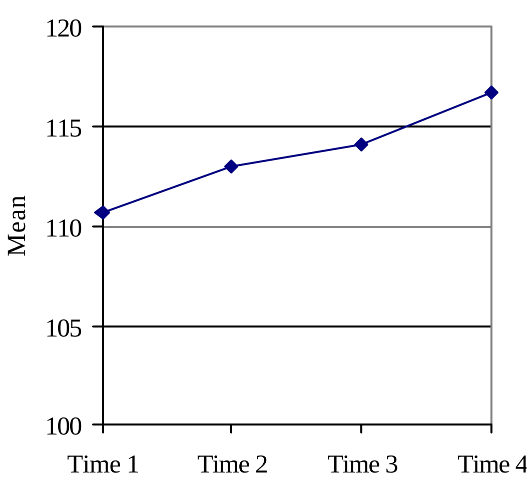
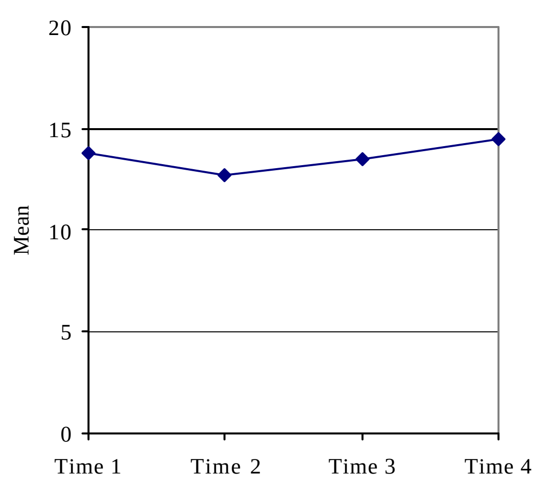


Figure 2
Self-Efficacy for Course Content



The results suggest that self-efficacy for both course content and online technologies is dynamic, indicating that self-efficacy is subject to change, even within a relatively short period of time (i.e. three weeks). A considerable change found in this study was the significant increase in student's level of self-efficacy for online technologies during the first three weeks of the semester. Commonsense dictates that, when students have more experience with online technologies, they feel more confident in using online technologies, and their self-efficacy increases, accordingly.

In predicting student's satisfaction with a course using the initial self-efficacy measurements, only course content self-efficacy was a statistically significant predictor ($t=2.77$, $p<.02$). This predictor alone accounted for 32% of the variance in satisfaction. When, however, a composite of self-efficacy for course content and self-efficacy for online technologies was used, the initial composite was a statistically significant ($R= .71$, $F_{2,13}= 6.7$, $p= .01$) predictor of student satisfaction. The resulting equation, Satisfaction = -2.89 + .4 (Online Tech) + 3.49 (Course Content), indicated that as self-efficacy increased for either online technologies or course content there was a resulting increase in satisfaction. Although initial self-efficacy for online technologies was not a significant predictor of satisfaction, more than 50% of the variance in final course satisfaction could be explained by the initial composite of online technologies and course content self-efficacy. By the third time period, self-efficacy for online technologies was a statistically significant predictor of satisfaction but self-efficacy for course content was not ($R= .74$, $F_{2,13}= 7.9$, $p< .01$). Overall, these results indicated that when these two types of self-efficacy were compounded, the possibility of predicting student satisfaction was increased. Consequently, we concluded that these two types of self-efficacy play substantial roles in predicting satisfaction.

Finally, the findings of this study showed that neither self-efficacy for course content nor self-efficacy for online technologies were statistically significant predictors of student performance until the fourth (last) time period. The resulting equation, Performance = 114.4 - .48 (Online Tech) + 2.99 (Course Content), indicated that as self-efficacy for online technologies increased, performance decreased; and as self-efficacy for course content increased, performance increased. The linear composite of self-efficacy for course content and for online technologies explained 40.1% of the variance in performance ($R= .63$, $F_{2,13}= 4.4$, $p< .05$).

Contrary to previous studies (Miltiadou, 2001; Wang & Newlin, in press), this study showed that initial self-efficacy for course content and online technologies was not a statistically significant predictor of student performance. The absence of a relationship between initial self-efficacy and performance might be due to the small sample size. However, in the last time period, a relationship between self-efficacy for online technologies and performance did appear. It is noticeable that the relationship was negative, indicating that students who were not efficacious with online technologies perform better than those who were efficacious. This finding corresponds with Miltiadou's (2001) study. A possible explanation for this phenomenon is that when online technologies were perceived as difficult and students were not confident in learning via this media, they were more likely to be cognitively engaged. However, when online technologies were perceived as easy, students seemed to expend less effort. Consequently, those who were efficacious with online technologies earned lower grades than those who were not efficacious. This phenomenon also appeared in Salomon's (1984) study, where the students considered learning from watching television easier than learning from reaching printed text. These students exerted less effort, resulting in poor performance.

Although self-efficacy for online technologies was negatively related to performance, a positive relationship was found between self-efficacy for course content and performance. This was consistent with research findings from previous studies conducted in traditional classrooms as well as online courses where self-efficacy was positively related to student achievement (Bandura, 1997; Locke, Frederick, Lee, & Bobko, 1984; Miltiadou, 2000; Schunk, 1981; Nicholls & Miller, 1994; Pajares & Kranzler, 1995; Wang & Newlin, in press).

Conclusions and Suggestions for Further Research

With the growing popularity of online education and the urgent need to curb the online attrition rate, understanding and fostering online students' motivation is imperative. This study investigated self-efficacy, a critical element of motivation, and identified its effects on satisfaction and performance. Although the small sample size of this study limits its generalizability to the larger population, the findings of this study revealed some important points: (a) self-efficacy, both for course content and online technologies, changed over time in a web-based course, (b) the initial composite of self-efficacy for course content and online technologies was identified as a significant predictor of satisfaction, (c) the final measure of self-efficacy with online technologies was identified as a significant predictor of performance (with a negative coefficient), and (d) the final measure of self-efficacy with course content was identified as a significant predictor of performance.

Given the findings of this study, there appear to be several implications for researchers and instructors in the field of online education. First, this study showed that self-efficacy is dynamic and changeable within the course of a semester. However, in previous studies (Miltiadou, 2000; Wang & Newlin, in press), the dynamic nature of self-efficacy was often overlooked and was measured only one time in order to predict satisfaction and performance. This approach does not provide a comprehensive picture of self-efficacy and, accordingly, reduces the researcher's ability to explain the impact of self-efficacy on learning. In light of this, a genuine examination of the effect of self-efficacy on learning requires repeated measures of self-efficacy. When multiple measurement of self-efficacy is not feasible, it is imperative to specify the point in the semester when self-efficacy is measured.

Second, in past studies on self-efficacy, attention was predominately paid to efficacy expectation regarding the content learned, and yet participants' efficacy with learning tools or instruction delivery systems was often neglected. Nevertheless, in a web-based learning environment, participants' efficacy expectation with online technologies can no longer be ignored. As shown in this study, while predicting satisfaction and performance in a web-based course, participants' self-efficacy with online technologies was as critical as self-efficacy with course content. More attention should be paid to students' efficacy expectations while teaching or designing a web-based course.

Third, this study showed an unexpected finding regarding the negative relationship between self-efficacy with online technologies and performance. Students who were confident with online technologies appeared to erroneously overestimate their abilities to deal with learning tasks, and thus exert less mental effort, which led to poor performance. To avoid the pitfall of faulty assumptions, students should be informed that no matter how proficient they are with the online technologies, participating in online learning requires no less effort than traditional classes.

The limitation of this study comes from its small sample size. In order to generalize the findings of this study, it is recommended that this study be replicated with a larger sample and with different types of classes in different academic settings (i.e. high schools, community colleges, and universities). In addition, the negative relationship between self-efficacy with online technologies and performance should be further explored. It is suggested that further studies look at whether students who are confident with online technologies do exert less mental effort in their online learning activities. This could unveil the mechanism that contributes to the negative relationship between online technologies self-efficacy and performance. Other studies could look at other possible predictors of student satisfaction and performance, such as task value, which has been identified as a significant predictor of both student learning achievement and satisfaction in traditional classes (Hammann & Stevens, 1998; Townsend & Hicks, 1995; Velayo & McKeachie, 1994). These findings could shed additional light into the prediction of student achievement and satisfaction in web-based courses.

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The Effects of Using Adult Learning Preferences for Trainers

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Introduction

This investigation examined whether or not the professional trainers could benefit from a needs analysis course in which real cases from various organizations were used and all the learning activities and materials were geared closely to the learning expectations and preferences of adults. Specifically, this study attempted to find out whether or not the use of five prominent adult learning preferences could enable the trainers to improve their (a) post-test achievement, (b) attitudes toward these preferences, and (c) performance in conducting individual needs analysis project. These preferences, which will be detailed in the methodology section, were derived from related literature on adult learning and included well-written, well-organized texts, lectures and handouts, and well-planned class discussions, reflections, and case studies.

Research questions of the study included: (a) were the use of the five adult learning preferences effective in helping the trainers comprehend and recall the needs analysis knowledge and therefore, perform better on the post-test? (b) were the use of the five adult learning preferences effective in helping the trainers apply the needs analysis knowledge and skills and therefore, be able to implement the individual needs analysis project correctly and effectively? and (c) what were the trainers' attitudes toward each of the learning preferences? In the following sections, related literature on adult learning characteristics and preferences is reviewed, which serves to provide a theoretical context for the study and to justify the rationale and the significance of the study. Then, the methodology of the study is detailed, and finally, the findings of the study, together with the implications of the findings, are discussed.

Adult Learning Characteristics and Preferences

Most literature on adult learning is theoretical, and theorists of adult learning believe that "forms of reasoning, thinking, and judging" of adults are qualitatively different from those characteristics of adolescents and children. This means, unlike adolescents and children, adults have more life experiences and are capable of building up a kind of situational reasoning to interpret their experiences and guide their actions during learning.

In providing a more comprehensive view concerning adult learning, Knowles (1980) pointed out that, adulthood should be defined as, when an individual is essentially responsible for his or her own life and is performing some types of acceptable social roles. Accordingly, adults, while assuming the role of learners, are different from child learners and possess distinct learning characteristics, which are qualities or traits of a person's learning. These distinct learning characteristics of adults include: (a) experience—adults often have rich life experience and are eager to find connections between new information and their experiences; (b) self-direction—adults enjoy directing their own learning and prefer to have freedom to choose their learning experiences based on their interests and/or needs; (c) readiness to learn—adults learn better when they are ready to or need to learn, and anticipate that the learning experience will match their expectations; (d) orientation to learning—adults prefer life-centered or task-centered type of learning versus subject-centered courses and want to apply what they learn in the classroom to real-life situations. Knowles (1984) also believed that adults are more motivated to learn by internal factors, such as increased self-esteem and confidence, than by external rewards like pay raises and job promotions.

In the past two decades, Knowles 's theory has been widely applied by other practitioners to discuss issues related to the learning preferences of adults. Learning preferences refer to the selection or choice of certain learning activities, situations or climates of an adult learner (Loesch & Foley, 1988). For example, Rosemary and Caffarella (1994) elaborated Knowles' theory and explained that adults not only have the need to examine and reflect on their past experiences and prior knowledge, but they can call upon these experiences and knowledge in formulating learning activities and in using them as learning resources. They believed that experiential learning activities, such as reflective journals, critical incidents, and portfolio development could be used to provide opportunities to help adults integrate their past and current experiences into the learning events. Rosemary and Caffarella further pointed out that, additional experiential activities, including field-based learning, small and large group discussion, role play, storytelling, metaphor analysis, case study analysis, and simulation are all effective in encouraging adults to engage in learning and communication with peers.

Other practitioners, including Charlton (1995), Collins (1999), Cross (1981), Dinmore (1997), Ference and Vockell (1994), Johnson (1995), Slusarski (1994), and Zemke and Zemke (1995), all provided suggestions for the use of various adult learning preferences to enhance learning. For instance, while presenting new information to adults, Cross (1981) suggested that: (a) one idea should be presented at a time to avoid overburdening the short-term memory of adults; (b) new information should be presented in an organized way that allows for mastery of the information and for the creation of relations between the new and previously learned information; and (c) frequent review and summarization should be made available to adults for assisting in retention and recall.

For enhancing abstract conceptualization among adults, Johnson (1995) recommended the use of a well-thought-out, well-presented lecture followed by a focused question and answer section. As for the design of learning situations, Collins (1999) suggested that the provision of structure and direction at the beginning of new activities are helpful to give adults a clear sense of what to expect from the learning journey. Charlton (1995) indicated that offering adults an interactive, performance-centered type of learning environment would be effective in helping adults integrate the new learning with their prior knowledge. Dinmore (1997) also pointed out that interdisciplinary courses that allow for the integration of knowledge derived in formal and informal environments are beneficial to adults. Ference and Vockell (1994) emphasized that adults like to take charge of their learning and are more self-reliant (1994, p. 25). They stated, "adult learners have often acquired their most successful skills through concrete, hands-on experience. They often prefer to continue this practice of learning by doing rather than by listening".

As for increasing adults' learning motivation, Zemke and Zemke (1995) suggested to: (a) make the content appeal to personal growth and gain; (b) describe the immediate and long-term relevance of the content to their lives; (c) stimulate curiosity about the subject matter; (d) ensure low risk for learner; and (e) explore the learners' positive and negative expectations. Finally, to promote adult's self-directing abilities, Slusarski (1994) agreed with other practitioners (Brockett & Hiemstra, 1991; Hiemstra & Sisco, 1990; Knowles, 1980, 1990; O'Donnell & Caffarella, 1990) that learning contracts can be effective in promoting self-direction among adults. Learning contracts that permit learners to " indicate what they will learn, how they will learn it, and how the learning will be evaluated" allow adult learners to plan subsequent learning activities in a more systematic way and therefore, grant them more control over their own learning.

In summary, theorists of adult learning believe that adults have distinct learning characteristics and preferences due to their rich life experiences. Adults learn when they are ready to learn and take pleasure in having self-direction during learning. They tend to build the newly learned information on their past experiences and prior knowledge. They are motivated by being able to see the relevance of the learning content and desire to link the new learning experience with their personal growth and gain. They want to have flexibility in choosing learning activities that are suitable for their learning needs and expectations. Finally, they prefer learning in a progressive manner and favor learning activities that are realistic, well-organized, and interactive.

Method

Research Design and the Participants

This study used the pre-test-post-test research design involving 53 trainers from an instructional analysis course at a north-eastern state university of the US. Among the 53 trainers, 17 were from the section of Fall II, 1998, 21 from Spring I, 1999 and 15 from Spring II, 1999. These trainers were all working full-time in local corporations, businesses, and educational organizations and were all enrolled as part-time graduate students. From the pre-assessment questionnaire, it was revealed that there were 41 females and 12 males with ages ranging from 23 to 50. Most of the participants had at least one to three years of training experience and had taken a course on the use of symptomatic models for training design and development.

Three major steps were included in the study. At the beginning of the class, in each section, the participants were given a pre-assessment questionnaire to gather data on their demographic characteristics, background in training and needs analysis, and their expectations in taking the course. A pre-test was then administered to measure their prior knowledge of needs analysis. After the pre-test, the participants then engaged in learning the knowledge and skills of needs analysis by using the five prominent learning preferences of adults. Throughout the learning process, the participants were expected to apply the content being studied to an individual needs analysis project. Successful completion of the project was required for passing the needs analysis segment. Upon completion of the project, the participants were asked to take the post-test and the attitudinal questionnaire to measure their post-test performance and attitude toward the learning preferences. The participants were not informed about the tests and the attitude questionnaire before taking them.

Learning Content and the Learning Preferences

The learning content included four human performance theories and models and five different data collection and analysis methods for needs analysis purposes. These theories and models included: (a) Allison Rossett's (1987) theory that seeks information to bridge the gap between the optimal and the actual performance, to examine feelings of performers or significant others, to identify causes of problems, and to propose solutions to the problem; (b) Robert Mager and Peter Pipe's (1970) Human Performance Model to examine performance discrepancies, skill deficiencies, and performance punishment issues; (c) Ron Zemke and Thomas Kramlinger's (1982) model to inspect the major human and organizational factors that affect people's performance in an organization; and (d) Thomas Gilber's (1978) theory and formula to calculate the ratio of exemplary performance to typical performance and to determine the potential for improving performance. The data collection and analysis methods included the design and conduction of interviews, focus groups, observations, questionnaires, and critical incident and document reviews.

The five adult learning preferences used were: first, an easy-to-follow textbook geared specifically toward needs and task analysis knowledge and skills, titled, "Figuring Things Out: A Trainer's Guide to Needs and Task Analysis" by Ron Zemke and Thomans Kramlinger (1982). Second, multiple sets of well-organized handouts that corresponded to the text and highlighted critical points of the learning contents. Both the text and handouts provided the participants with an organized means to learn the new and unfamiliar theories and skills of needs analysis. They also set directions for the learning sequences and allowed the participants to conduct frequent previews and reviews of the learning content.

Third, well thought-out and well-paced lectures were used to facilitate participants' conceptual understanding of the aforementioned theories and data collection methods. Also covered by lectures were real examples of needs analysis studies conducted in various organizations and how the knowledge and skills learned in the course could be applied both personally and professionally. Fourth, following lectures, class discussions were encouraged for the participants to ask pertinent questions, to share ideas with peers, and to stimulate critical reflections on the learning content. During discussions, all the participants were ensured a safe climate in which to exchange constructive information and prior experiences in the areas of training design, and needs analysis.

Fifth, a training performance related case in a business organization was used for the participants to analyze by applying the newly learned theories. The participants in each section were divided into four groups and each group was provided with detailed information about the case. Then, each group was assigned to use one of the four aforementioned theories to analyze the needs of the case. Upon completing the needs analysis for the case, each group had to present the analysis process, the conclusion, and the solutions for the situation. Each group was encouraged to provide reflections on the practice. This practice granted the participants to have an experiential activity that required the application of the newly learned theory to analyze training and performance issues in a real situation. It also permitted the participants to work in a group setting that had a specific goal to reach, was task-based, and needed to be interactive in order to complete the assignment.

More cases were created for the participants to have concrete, hands-on experience to collect, analyze and interpret the meanings of relevant data. Specifically, in this activity, the participants of each section were divided into two groups to analyze if there were performance related gaps or problems in the library and the computer lab of the university that they currently attended. Each group acted as if it were a focus group discussing its experiences in using the services provided by either the library or the computer lab. The discussion evolved around (a) if there was a gap between the service they received and the optimal service they would like to have had; and (b) if there was a gap, what caused it? Based on the results of the discussion, each group then designed a brief observational tool for conducting needs analysis in the library or the computer lab and developed a brief interviewing agenda with which to interview the staff of the library or the computer lab to gather more information. It was suggested that the groups try to create a situation or situations that would allow the group to observe the service provided by the library or the computer lab personnel. Based on the observational tool and interviewing agenda, each group gathered the needs analysis data. Finally, each group had to analyze the data collected from both the observation tool and interview, and recommend a solution based on the findings.

Research Materials

Research materials included a pre-test, a post-test, and an attitudinal questionnaire. All the research materials were developed by the researcher of the study and further reviewed by a colleague of hers, who had a Ph.D. in Instructional Design and Technology and had more than ten years of experience in conducting adult training. The pre-test contained eight open-ended questions, corresponding to the eight learning objectives for the needs analysis section. The wording was changed only slightly to present the objective in question format. Four of the questions covered the four aforementioned theories for needs analysis, and the other four included data collection methods. The post-test was identical to the pre-test except that the questions were presented in a different order.

The attitudinal questionnaire was designed to gather the students' perception of how helpful the used learning preferences were in learning and applying the course content, as well as, how much they enjoyed them. The participants were asked to rank them one through seven, with one being of the least assistance or least liked and seven being of the greatest assistance or the most liked. To avoid bias in the participants' responses and obtain a clearer picture of the participants' attitudes, the questionnaire also included questions on all activities used in the course including the text, lectures, handouts, class discussions and reflections, group-based case studies and presentations, final project, and a combination of all these activities.

In addition, the participants were asked about their perception regarding which activity was most crucial in helping them achieve certain learning outcomes. Specifically, these outcomes were: to recall the learning content, to explain the content to someone else, to analyze the content, to apply the content, to synthesize the content in a meaningful way, and to evaluate the value and usefulness of the content.

Data Collection and Analysis

The pre-and post-tests were scored using a predetermined answer key. A set number of points were assigned to each question based on the scope and difficulty of the question with the total possible points equal to 100. Answers were broken down into sections, and partial credit was given. A paired t-test was performed to determine if the results of the two tests were significantly different from each other.

For the needs analysis project, it is necessary that a needs analysis be based on a real performance or training related issue of an organization. Written guidelines detailing the purpose, procedure and expected outcomes of the final project were made available to the participants prior to the implementation of the project. There were five criteria used to evaluate each project and 20 points were assigned to each criteria. These criteria were: (a) the analyzed situation of an organization was clearly and completely described; (b) an attempt was made to analyze the situation by applying appropriate theory(ies); (c) a hypothesis was formed and effective data collection method(s) was (were) used to test the hypothesis; (d) an objective or scientific reporting of the collected data was included and data was accurately analyzed and interpreted; and (e) effective solutions/recommendations to bridge the performance gap or solve the problem in the situation was proposed.

Two analyses of variance, ANOVA, were first performed for ranking (a) how much the activities helped the participants in learning the content, and (b) how much the participants liked the activities. Once a significant F ratio was revealed by an ANOVA, the Tukey's test, with the total error rate of $\alpha=0.05$, was performed to determine which ranking means differed significantly from one another. Percentages of responses concerning how the learning preferences helped in reaching each level of learning (recall, comprehension, application, analysis, synthesis, and evaluation) were also calculated.

Results

The Pre- and Post-tests

A paired t-test was first performed to determine if there was a significant difference between the pre-test and post-test performance. The results revealed that the participants performed significantly better in the post-test than in the pre-test, $t(52)=34.19$, $p<0.0001$. The following Table presents the means, standard deviations, and differences of the t-test results for the pre-and post-tests.

Test	N	Mean	StDev	T	P-Value
Pre-test	53	3.00	6.19		
Post-test	53	79.64	16.58		
Difference		76.64	16.32	34.19	0.0000*

* p<0.0001

The Project Performance

All the participants performed very well in conducting the individual needs analysis project (mean=89.972, median=94.00, and St. Dev.=13.42). Table 2 lists the means and standard deviations of the participants' performance in reaching each criteria of the project.

Criteria	Mean*	Median	St. Dev.
Situational Description	18.214	19.000	2.521
Theoretical Analysis	18.337	20.000	2.706
Data Collection	18.393	20.000	3.240
Data Analysis and Interpretations	17.661	20.000	4.231
Recommendation of Solutions	17.321	18.500	17.800
Overall	89.972	94.000	13.42

Discussion

This study revealed a significant performance improvement from the pre-test to the post-test and an outstanding project accomplishment, which lend increasing support to the use of adults' learning preferences. These results suggest that the factors, which impact the professional trainers' learning and the application of the needs analysis knowledge and skills, are mutually dependent. It may be that a good text provided a systematic description of the covered content. Well-organized handouts called the trainers' attention to the most important aspects of the content. Well-thought-out and well-paced lectures further interpreted and analyzed the meaning of the content. Group-based discussion allowed the trainers to share their expertise and related experiences among themselves, and further increased their incentive to learn. Realistic case studies set up scenarios for the trainers to approach and analyze the case and therefore, invoked deeper understanding of all the important factors involved in each case. A combination of these reasons may have accounted for the trainers' success in increasing post-test scores, in doing a great job for the individual needs analysis project, and in developing a more positive attitude toward the combined use of the five learning preferences.

Also, from the results, case studies were perceived by some trainers to be helpful in comprehending and recalling the content. One reason for this may be that case studies demanded the trainers to put the newly learned information into practice and, therefore, empowered them to make a connection between the knowledge and skills gained, and their application. In addition, the project work was cited by most trainers to be effective in helping them apply, synthesize, and evaluate the learning content. It may be that a purposeful, individual project was effective to enhance self-initiation and the self-directing abilities of these trainers. With these abilities, they were able to derive more meaning from the process of accomplishing the project, thereby increasing the ability to apply, synthesize, and evaluate the content. Another reason is that these learning preferences were arranged in a progressive manner. The participating trainers were permitted to build their learning progress hierarchically due to this manner. That is, by the time these trainers were engaged in the project work, they had acquired all the necessary competencies in conducting the needs analysis project. Because of this, they felt more confident in finishing the project and felt that the project work was most beneficial in helping them accomplish most of the learning objectives.

Furthermore, a high level of learning motivation and professional interest held by these trainers may have contributed to their positive learning results. The participating trainers demonstrated their motivation to learn in many ways, such as attending classes regularly, engaging in group discussions, and participating actively in case studies. Most of them expressed concerns of conducting needs analysis studies on a trial-and-error basis in the past and were eager to acquire a formal education on the subject. While learning the subject, they truly appreciated the pragmatic nature of the subject, were very enthusiastic about the strong connection from theory to practice provided by the course; and were excited about the possibility of applying the acquired knowledge to their jobs. Therefore, the desire to learn came from within, and such a desire, eventually, made these trainers outperform.

Despite the positive results of the study, there were a couple of limiting factors involved in the study. First, the study did not provide an opportunity for the participating trainers to reveal how, and why, the combined use of the five learning preferences worked for them. For example, in what way did the five learning preferences help them have a successful construction of new concepts about needs analysis? To what extent did the use of realistic, open-ended case studies stimulate these trainers to apply the newly learned knowledge and skills? Second, this study did not investigate the long term effects of these preferences. Questions that need to be answered include: will the positive learning results acquired by these trainers be sustained over a long period of time? Will these trainers continue to achieve successful transfer of the needs analysis knowledge and skills?

Accordingly, for future research, it is necessary to use think-aloud interviews for the participants to discuss, in detail, how and why the use of adult learning preferences assist them to construct, internalize and apply the knowledge and skills of needs analysis. Researchers also need to determine the long term impact of using the preferences of adults to learn subjects with a pragmatic nature. In addition, questions regarding which adult characteristics and/or preferences should be integrated into the learning of different skills including psychomotor, verbal, cognitive, or attitudinal need to be answered. The examination of other factors such as levels of learning motivation, professional interests and needs, and prior knowledge and experiences, which all have impact on adult learning, is necessary.

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Teachers' Perceptions of Technology: Four Categories of Concerns

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Introduction

Today, many educational institutions have been challenged to integrate technology into their work settings. Technology is a mean of supporting goals related to increased student involvement with complex, authentic tasks within classrooms and schools (Scheingold, 1991). However, successful technology integrations are sometimes confronted with several difficulties, which include clients' resistance to change (Conner, 1992; Collins, 1991) or the lack of cooperation of the part of the people involved in that change (Kemp, 1996).

Recently, researchers argue that an innovation without considering clients' needs or concerns usually resulted in resistance to change (Ertmer, 1996; Hall & Hord, 1978; Dormant, 1986). The reason for this problem is a lack of attention to the clients' attitude, perceptions, and concerns that people form toward innovation. These concerns play an important role in the innovation process as well as in the inherent quality of the proposed change (Pershing, An, & Lee, 2000). Hence, identifying and addressing concerns and perceptions are an essential task of change agents during the whole innovation process. In this article, I will introduce a framework for analyzing clients' concerns and perceptions based on an information technology project that has been implemented in a seminary setting during the last five years. While conducting interviews with the teaching faculty members who participated in the information technology project at a seminary, I identified four categories of concerns. In this article, I will explain the characteristics of and interventions in each category of concern.

Context of the Case

In the mid 1990s a seminary in the Midwestern United States was awarded an externally funded grant for a technology initiative, which included developing instructional computing capabilities throughout the school (Saint Meinrad, 1995). The seminary hired two instructional interns to provide computer training to the seminary faculty and staff. At the beginning phase of the initiative, the interns conducted a training needs analysis. The main focus of the analysis was to gather information about the kinds of training programs faculty and staff members would need. Through the analysis, however, several concerns surfaced (Saint Meinrad, 1998). For example, the faculty members did not seem to think that computer technology was a tool useful for theology education, which emphasizes personal interactions within small groups. Administrators of the initiative, however, did not pay much attention to this perceived concern. They proceeded on the assumption that faculty members always complain about new initiatives, and they viewed such concerns as natural. They assumed that faculty members would eventually accept and use computers provided the faculty members received the proper training. With these assumptions in place, the administrators put effort into collecting and addressing training needs information while ignoring their concerns.

After the interns had provided in-service training for one year, they began to make informal visits to the classrooms, computer labs, library, and the faculty resource center. They found that many faculty members were not integrating computers into their teaching. According to the project implementation plan, almost all faculty members should have been using computers in their instruction after one year, since all the necessary facilities and training had been provided.

Faced with such resistance, the administration began to take the idea of concerns seriously. The administrators of the seminary learned it was not the lack of facilities or training, but concerns of the faculty that affected the success of the initiative. With this realization, they asked the interns to conduct a concerns analysis. One-on-one interviews and document analyses were used as data collection methods. All twenty-six teaching faculty and several administrators and staff of the seminary were interviewed (Lee, 2001). After conducting many rounds of card sorting, the interns identified four categories of concerns as below.

Category I: Concerns of Individual Incompatibility

Faculty perceived that the project was not compatible with their theological values or past personal experiences. These concerns had a critical influence in the earlier stages. Some faculty who understood and were well informed about the project, however, had not embrace it because of their perception of technology as opposing theological pedagogy. If they were not persuaded during the earlier stages, then it was hard to accept the project. Hence, this area of concern was critically important in the earlier stages of an innovation project, but its importance declined in the following stages. The following are several representatives of this area of concerns.

<u>Conflicts of Needs between Institution and Faculty Regarding Technology</u> A definite incongruence existed in needs between individual faculty and the seminary as a whole. The institution had emphasized that technology was the only tool to increase learning effectiveness in the information age. However, to the individual faculty, using technology was just one of many ways to improve learning methodologies. As one faculty pointed out, to accomplish the goal, it was not necessary to incorporate

technology, because technology was not the only way to accomplish the goals. Furthermore, overemphasis on technology at the beginning stage of the project negatively influenced all faculty members.

Skepticism about Technology Ten faculty members among the 26 were very skeptical about technology. This resulted from their not being aware of the worth, potential benefits, or value of technology. Also, they were not convinced that technology was indispensable for their academic setting or their personal lives.

Paradigm Paralysis Fourteen faculty members out of 26 expressed this category of concern, which was the largest barrier to adopting technology among the faculty members of the seminary. This concern can be broken down into two sub-categories: the faculty's perception of technology as opposing theological pedagogy, and the faculty's comfort with current teaching styles. Faculty members thought that technology (or the information technology project) was basically incompatible with their theological context.

Theology, they argued, should focus on nurturing human nature, which is only possible with human interactions between instructors and students. In this point, they felt that their particular theological discipline could not adapt itself to technology because theological educators are suspect of the value of technology beyond the basics of classroom pedagogy. The other reason is that they believed their current teaching style had worked well for several decades, so there was little desire to take the time to change it.

Fear of Technology Nine faculty members expressed fear of technology in two forms: fear of the unknown and fear of the new. Some faculty were afraid something would go wrong with the computers. Most faculty said that they had not grown up in the technology culture. To them, technology was a foreign area. Even adopters of the innovation expressed concerns that technology had advanced so drastically that keeping pace with the advancement of technology seemed impossible.

Laggard Syndrome Nine faculty members perceived themselves as being far behind in using technology. One faculty who used technology in his classroom setting even expressed that he was at the knowledge stage, still trying to find out the benefits of technology.

False Information/ Irrational Belief Seven faculty members sympathized strongly with the criticism that technology is not a learning tool proper for the seminary. Some faculty mentioned that technology is a deterrent to human learning and communication. Those arguments were not based on scientifically proven facts but were based on personal feelings or subjective reflections. However, these feelings have not allowed them to see the potential benefits of the technology.

What are the effective interventions should be needed to address this category of concerns? Rogers (1995) indicated that person-to-person communication is important to address this area of concerns. Dormant (1986) also suggested that change agents should be counselors who draw out concerns, and listen to and clarify the adoption units' needs and interests. Hence, individual persuasion is a useful strategy to address this area of concerns by providing counseling and consultation sessions. The seminary realized that persuasion on an individual basis was the best strategy after noticing faculty's resistance to the innovation.

The seminary recognized that a core group was very skeptical about technology even after several years had passed since the innovation started. To identify their concerns, the seminary conducted one-on-one interviews with faculty members to become aware of the many issues that related to this area. The seminary stressed that Instructional Service staff were not attempting to change faculty's teaching styles, but to enhance their teaching styles with the use of technology. Also, the seminary published a monthly technology newsletter, both in print and on the intranet, featuring articles on the individual-incompatible area of concerns. Several faculty members wrote articles mentioning their successful experiences with technology in their teaching settings. The seminary provided opportunities for faculty members to visit other advanced technology-driven education institutes or learning opportunities to familiarize them with the practical applicability of technology in the seminary context. Also, more than ten faculty members attended technology-related seminars, conferences, and workshops.

Category II: Concerns of Unknown

Even when the value of an innovation is compatible with the target audience's values, the individuals of the adoption units may not accept the proposed innovation as planned for several reasons, including fear of the unknown and lack of information or knowledge required to implement the innovation. In the earlier stages, the individual faculty usually felt fear of the unknown or fear of lacking required knowledge or skills. The following are the typical examples of this category of concern.

More Work To eight faculty members, technology was one more burden that they had to learn. Technology adds or creates another task. Even faculty who used technology in the classroom expressed this concern most often. To learn technology was becoming increasingly stressful and time consuming for the faculty members.

Lack of Detailed Information about the Project The vision of the project was not address well to all faculty members. The lack of vision also made it difficult to set up the details for diffusing the innovation. Five faculty confessed that they were not aware of the detailed tasks in relation to the innovation. They expressed concerns about how technological innovations were to apply to the particular learning environment.

Teaching/Mentoring Concerns Providing individual teaching or mentoring was an effective means of adopting the technology by faculty members. Individual training was preferred over group sessions by the school faculty. Several reasons were expressed. The difficulty of finding a common time among faculty members and consideration of individual pacing were major reasons.

Time Conflict Eight faculty mentioned that time was one of the most important concerns in their not adopting technology. They said that technology was not a priority to them, for their primary responsibility was to prepare a class or preach. Some faculty had not even tried to learn technology because they worried about how much time would be spent.

Students' Unfavorable Attitudes toward Technology Students' unfavorable attitudes toward technology were also mentioned by two faculty members. Ironically, faculty members who had unfavorable attitudes toward technology mentioned that students showed the same phenomena. Two faculty expressed that students did not say that the technology helped them. That made some faculty not use much technology in classrooms.

Lack of Information about Good Applications Four faculty members said that it was hard to find someone who had applied technology very well. There was no easy way to identify other faculty members on campus who had already begun to use technology effectively in their teaching. And for most theological disciplines in particular, there was no comprehensive, easy-to-find source of information about relevant instructional applications of technology. While the number of locally successful models of educational uses of technology continued to increase, access to good descriptions of those models, training for them, and reports of their strengths and weaknesses were not easy to find.

The major strategy for addressing this category of concerns is learning, because usually these concerns can be overcome by providing well-organized training programs, job aids, and consultation programs. Also, providing correct information in a timely manner is another useful strategy to address this area of concern. However, the faculty's learning focus changed from general and basic issues of technology to more elaborate and complicated issues, such as transferring or applying the technology in more specific contexts in this case. This is why the learning format changed over time from the general group-based to the individual customized format.

To identify issues in this area and set up learning interventions, the seminary conducted a needs analysis project by conducting interviews with each faculty member as well as mailed surveys (Saint Meinrad, 1998). Based on these phenomena, several learning interventions were arranged in the seminary. First of all, an individual learning road map for each faculty member was developed. According to the road map, the well-organized technology training programs were provided for the following year. The interns had been working on-site on a weekly basis. After taking these programs for one year, the faculty improved their computer competencies from 2.5 out of 5 on the Likert scale to 3.1 in the same survey (Saint Meinrad, 1998). As the faculty moved deeper into the innovation, the focus of learning shifted to more individualized consulting and one-to-one training sessions. Also, remote consulting was offered by using electronic communication channels between the faculty and the outside interns.

To address time concerns, the seminary formed a committee to reorganize teaching loads. The recommendation of the committee was that the eclectic courses could be cancelled if few students enrolled, so the faculty could be learning at that time instead of teaching the course. Also, lack of time to learn was the most crucial factor in this category of concerns in this seminary. To address this concern, the seminary developed a training schedule that was flexible, meeting at different hours of the day, even evenings, so that the faculty could best take advantage of the offerings.

Category III: Concerns of Organizational Support

The organizational-compatible concerns were salient factors to be considered at the middle stage of the project at the seminary. Faculty who understood the benefits of the innovation did not adopt it because there were no organizational encouragements to do so. Many faculty members expressed concerns about the lack of organizational supporting systems and motivational systems. The following remarks are the typical expressions of this category of concern. The following are several representative examples of this category of concern.

Equipment and Maintenance Problems Several concerns were expressed in this category by seven faculty members. First, the faculty experienced difficulties when servers went down, especially after hours or on weekends. Some buildings were not equipped with technology. Not much software was installed in the Faculty Resource Center (FRC) or the Educational Technology Center (ETC), which made programs hard to access when needed. Services from maintenance persons were hard to find or untimely when computing problems occurred. Students may not have had support from the seminary to fix their computers if the computers had problems.

Students' Limited Access to Equipment and Support Services Three faculty members of the 26 mentioned that students' opportunities to access technology were limited. Not all the students' rooms and classrooms were wired. Some students could not access the technology, so electronic communication was sometimes impossible. Also, the computers in the student production center were so old that students could not use advanced software.

Students not Involved Three faculty members mentioned that students were not involved in the innovation from the start. It was directed to the faculty group only and it began without asking how students would learn or use the technology.

Lack of Organizational Benefits Lack of organizational benefits and motivational factors were mentioned by seven faculty members out of 26. The institution did not recognize the adopters of the innovation. Two faculty mentioned they might have adopted it if the institution had offered some motivation or incentives, such as monetary benefits. Suggestions of non-monetary benefits were also mentioned, such as vacations and training opportunities, and to lessen the teaching burden.

Distrust and Poor Communication Among Stakeholders There was little communication and coordination among stakeholders during the innovation diffusion process. The innovation initiators did not even try to gather ideas from the three constituent groups, faculty members, staff, and students, in order to make the most effective uses of technology, new approaches to teaching and learning, and other available resources in the seminary setting. Six faculty of the 26 expressed problems with innovation in this category.

This area of concerns is relatively easy to measure and to eliminate if addressed carefully and in a timely fashion during the innovation diffusion process (Fisher, Wilmore, & Howell, 1994). Traditionally, most change scholars have overlooked these concerns at the beginning. However, in order to lead a successful innovation project, the plan has to be reviewed regularly during the innovation process. Raising money, allocating resources, and providing technical and administrative support, including incentives or motivational systems, are essential elements.

These concerns can be eliminated by acquiring resources and equipment, providing timely technical and administrative support, providing incentives or benefit systems, and maintaining equipment. Foa (1993) pointed out that incentives, support, and reward structures are needed in order to make the efforts of the individuals more widespread and their results used more comprehensively. Major problems for the seminary lay in the institution's failure to provide motivation or incentives to encourage faculty members' active usage of the innovation. Many faculty suggested both monetary and non-monetary benefits and motivators, such as vacations, training opportunities, and a lessened teaching burden. While not providing any monetary benefits, the seminary provided many forms of non-monetary benefits, such as providing training programs and visiting other technologically advanced schools. The director of the Academic Computing Department became a member of the president's cabinet, a group of advisors to the president, and thus was directly involved in developing a new master plan, which included major renovations of several buildings over the next five years.

Category IV: Concerns of Organizational Incompatibility

Last category of concerns is related to the organizational incompatibility. Faculty expressed that the innovation was not compatible with the seminary culture. The seminary culture was oriented toward more human interaction, and focused on formation-building. Furthermore, the seminary was isolated geographically, as well as divided by disciplines. They also expressed their isolation regarding the innovation. The innovation was initiated in a top-down manner. They did not receive information in a timely fashion. Clear goals and directions for the innovation were not given to the faculty. Furthermore, faculty tended to work individually rather than in teams. Every faculty member understood the innovation differently. Hence, they perceived that two incongruent innovation diffusion tracks existed in the seminary: the individual faculty track and that of the institution. This concern began to increase in importance after addressing the individual-incompatible concerns, but increased strongly in importance at the implementation stage during the diffusion process. The following are several examples of this category of concerns.

Isolated Culture The cultural characteristics of the seminary, 4 faculty argued, were not compatible with technology. First, in preparing people for the ministry, the top priority of the seminary is fundamentally different than preparing people to teach in other higher educational institutions. The use of technology can be maximized mainly in the latter setting. Religious organizations such as the seminary must emphasize the value of forming and building relationships, which does not embrace technology. Hence, some faculty mentioned that technology was not a driving force at the seminary. Second, faculty had not grown up in a technology culture. Some faculty mentioned that the European learning model, which mainly uses lecture format in classrooms, had influenced the faculty members who had studied in Europe, who were the majority in the seminary. Third, the individuality of faculty members was another cultural characteristic. Most of the faculty pursued different disciplines and different areas of interest. That was the major reason why faculty were accustomed to working individually rather than in teams, which the innovation sometimes required them to do.

Class Characteristics Another reason for incompatibility originated from the class contexts that were small-group class setting and technology was not related the course content. Five faculty members argued that technology could not make an impact in a small class. Most of classes were populated by fewer than 10 students. In this situation, technology was ineffective for increasing learning. The other reason why the faculty did not utilize technology during class was their perception of the inability of the course to embrace technology.

Sharing and Showing Learning technology was one of the biggest concerns of the faculty members. Nine faculty members of the 26 expressed this type of concern. Sharing information about, or experiences with, technology among faculty was vital, and it could have been a strong influence on the faculty as a whole. Partly owing to a lack of vision for the innovation and to a lack of concrete examples of how to apply technology in a seminary setting, the faculty wanted to see other people's experiences and or knowledge.

Not Having a Clear Image of the Project Eleven faculty out of 26 expressed a lack of vision for the project from the beginning. This area of concern was the second largest barrier for the faculty. They argued that the innovation project was started by grant money rather than a vision. Without serious questions about why this innovation was needed in the seminary, the institution started the innovation, and this made it difficult for the faculty members to grasp the vision or purpose of the innovation.

Fragmented Technology Planning Five faculty members argued that the innovation was started without considering the necessity of information technology carefully in the context of Catholic pedagogy. They expressed that the innovation was focused on teaching rather than learning, and focused on media rather than methods. Two faculty criticized the innovation for starting in reverse order, selecting media (buying computers) without considering methods. One faculty mentioned that this project had missed one critical stage in the beginning: needs assessment or values clarification.

Collaboration was the most useful strategy to address this area of concern in the seminary. To address issues of this area, the seminary's geographical isolation, diverse faculty disciplines, and a top-down diffusion strategy, collaborative work among the faculty was essential. For example, creating a vision statement and sharing the innovation-related experiences with other individuals in the adoption units were helpful tasks in the seminary.

The seminary formed an ad hoc committee to set up a clear vision for technology and teaching at the seminary. The committee developed a vision with consensus from all faculty members and reported their findings to the faculty. Another intervention was to arrange several learning events in order to facilitate collaborative work among faculty members in the seminary. Through these events, faculty members shared their ideas with other faculty members. Sharing among faculty was the key activity for changing the seminary culture. These events included faculty presentation day, faculty learning day, small group interests, brownbag lunches and learning sessions. Also, through the funds from the grant, many faculty took advantage of conference opportunities to gain more knowledge about the appropriate use of technology. Furthermore, the seminary developed contacts with other schools facing the same issues and was able to find and demonstrate good practices in technology for theological instruction.

Concluding Remarks

Information technology is an effective means of increasing teaching and learning effectiveness in higher educational settings including seminaries. However, it must be well planned and organized before the project begins. Identifying clients' concerns and taking care of them are an important task of change agents during an innovation process. Setting up a vision statement, conducting perception analysis, and preparing detailed plans for the project would guarantee a successful implementation of an information technology project in a higher education setting.

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An Instructional Design Theory for Interactions in Web-based Learning Environments

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Introduction

Universities across the country are offering a growing number of courses on the World Wide Web. Many faculty and instructors are now faced with the challenge of teaching at a distance in a Web-based environment and are collaborating with instructional designers on how to effectively design Web-based distance education courses.

Teaching at a distance requires different strategies than those used in a traditional teaching environment. In traditional classes, interactions between learner and instructor and among all learners in a class are mostly synchronous. Often a lack of interaction has been considered a major weakness of distance education, blamed for causing feelings of isolation in learners who are situated all over the world with no or minimal face to face contact. Interaction between the learner and the course materials and resources can be hindered by new and unfamiliar technology. Nontraditional learners taking courses on the Web may not have the self-regulation or study skills to perform well in this environment. Interactions on each of these levels have been identified as a critical component for successful online learning (Hirumi & Bermudez, 1996; Moore, 1989; Roblyer & Ekhaml, 2000; Schrum & Berge, 1997; Vrasidas & McIsaac, 1999; Wagner, 1994), yet it can be extremely difficult for instructors to foster interactions in a distance environment.

Much of the literature regarding interactions in distance education has focused on the development and use of technology tools that permit interactivity or have focused on interactions as if they are the outcomes of instruction rather than the methods of instruction as pointed out by Wagner (1997). Little research has focused on interactions as instructional methods rather than outcomes.

An instructional design (ID) theory is a "theory that offers explicit guidance on how to better help people learn and develop" (Reigeluth, 1999). ID theories are prescriptive and design-oriented, identifying methods of instruction (including instructional strategies and tactics) and the situations in which these methods should and should not be used, based on the instructional conditions and desired outcomes.

The current study developed and formatively evaluated an instructional design theory to guide designers in selecting when and how to utilize interactions as instructional methods in a Web-based distance learning higher education environment.

Research Questions

1. What are the types and outcomes of interactions between participants in a Web-based learning environment?
2. When and how should these various interactions be designed into a Web-based learning environment?

Methods: Phase 1

Construction of New Instructional Design Theory

Phase 1 of the research methodology involved construction of the new instructional design theory. A type of formative research methodology, as described by Reigeluth and Frick (1999), was used to create and test this new instructional design theory. Specifically, we designed a particular case in which to develop the new theory. We chose an instructional situation (a Web-based graduate course) that we wanted our theory of interaction to apply to, helped to design the case (the course), and developed a tentative design theory in parallel. The case, therefore, became an instance of the theory.

The designed case was that of a Web-based distance graduate course in educational psychology at a large Midwestern university. The course is required for many programs in the school of education. The course is run entirely through a course management system on the Web. Both researchers were involved in the course design process, as recommended by Reigeluth and Frick (1999). By participating in the course design, it fosters "intimate familiarity with the case [which] is essential for developing good grounded theory" (p. 644). The design theory was developed in parallel with the course.

A five-member design team, including both the instructor and associate instructor, met once a week for approximately three months to design and develop the course. The researchers documented the design decisions and rationales as they developed the theory. This included documentation of intended learning outcomes; selection of methods, strategies and tactics; documentation of situationalities which influenced design decisions; and identification of the values behind instructional decisions.

The overall learning outcomes for this graduate course were for students:

- To become conversant with the basic assumptions, concepts and principles of each learning theory
- To determine the possible implications of each theory for instructional settings
- To be able to compare and contrast theories and their usefulness in the various settings of interest to the students in the course and other education professionals

- To create and revise a personal theory of learning

Throughout the design of the graduate course, we consistently documented our rationales for the selection of particular methods for particular learning outcomes, particularly as they related to use of interaction methods. We referred to the design notes to identify what the intended outcomes were for the method and extrapolated the instructional conditions and instructional outcomes.

The following procedure was used (Reigeluth, 1983; Nelson, 1998) to develop the theory in tandem with the designed case study:

Define the Purpose of the Theory

The purpose of this theory is to provide guidance for designers of Web-based graduate courses on when and how to utilize learner to learner, learner to instructor, and learner to resource and learner to self-interactions as instructional methods. Interactions as an instructional method contribute to the outcomes of the instruction such as team building, clarifying understanding, supporting learner control and enhancing elaboration and retention (Wagner, 1997).

Define the Values of the Theory

According to Reigeluth (1999), values "guide selection of goals and selection of methods" (p. 12). The values that guide this theory include:

- A belief that adults are most motivated to learn when they feel success, volition, value and enjoyment
- Higher-order thinking skills and complex cognitive tasks are best fostered by interacting with other learners to socially construct meaning
- Instruction should provide variety
- Instruction should foster creativity
- Instruction should be authentic and relevant to learners' lives
- Instruction be related to previous experiences and linked to prior knowledge
- Resources should be available to help learners with their tasks
- Activities should build on previous work done in the course
- Instruction should provide social as well as cognitive support
- All learners should have the chance to participate
- Cognitive overload should be avoided
- Learners should have responsibility for their own learning

Determine the Specific Domain, Situation or Scope of the Theory.

This theory addresses learning in the cognitive domain. It is applicable to learning situations with adult learners in higher education settings, particularly Web-based learning environments. The scope of the theory is specifically to provide guidance on when and how to utilize interactions as instructional methods that can be used effectively to attain cognitive outcomes.

Identify an Optimal Participant Interaction Process on which to Model the Theory.

The development of an optimal participant interaction process used in this study is based on previous experience of the researchers both as students and as researchers. This serves as a framework for the synthesis of the review of the relevant literature. The review of the literature can be seen as an initial formative research of the developing theory.

Moore (1993) points out that distance education is not simply a geographic separation of learners and teachers, but more importantly, a pedagogical concept. It is a concept describing the universe of teacher-learner relationships that exist when learners and instructors are separated by space and /or by time (Moore, 1993). From this separation, special patterns of learner and teacher behaviors that affect both teaching and learning are formed. The psychological and communications space of potential misunderstanding between the learners and instructors is called the transactional distance. The three sets of variables, which define the extent of transactional distance in an educational environment, are dialogue, structure and learner autonomy. 'Dialogue' can be translated as interaction, which places value on the synergistic nature of relationship of the involved participants (Moore, 1993). Based on this theory, interactions are even more important in distance environments than in residential environments, as when participant are separated by space and time the transactional distance is more difficult to overcome.

Vygotsky's (1978) understanding of learning as a social process is also critical to the discussion of distance learning theories. Various technologies and tools used for distance education create the context and setting where learning can occur. In Vygotsky's concept of the Zone of Proximal Development (ZPD), social interaction is crucial to the development of the new patterns of thoughts and behaviors.

The tools and signs the learner is exposed to play a great part in influencing or mediating the new patterns of thought and mental functioning (Werstch, 1991). Under the socio-cultural framework, what is meant by knowledge and learning is a change in perspective. If meaning must be personally constructed, then the learner is central to the learning process because personal experience determines reality. Hence, there is a need to consider instructional design from a more learner-centered perspective. Bonk and Cunningham (1998) incorporated the framework of sociocultural theory and principles for computer-supported collaborative learning (CSCL) environments. Compared to the cognitive constructivists' focus on making learning more relevant and building on students' prior knowledge, social constructivists emphasize human dialogue, interaction, negotiation, and collaboration (Bonk, Oyer & Medury, 1995). It is argued that social interaction and dialogue is central to learning. New skills and strategies first appear in a social place with adults and more capable peers in one's learning environment and are later internalized (Bonk, Appleman & Hay, 1996).

Thus, interactions among others in the learning environment are important to the learning process. Interaction itself can be defined as "sustained, two-way communication among two or more persons for purposes of explaining and challenging perspectives" (Garrison, 1993, p.16) or as "two-way communication among two or more people within a learning context, with the purposes as either task/instructional completion or social relationships building" (Gilbert & Moore, 1998).

Moore (1989) distinguishes three types of interaction in distance education: 1) Learner-content interaction. The learners are constructing knowledge through a process of accommodating new understanding into their cognitive structure; such interaction with content is one way to restructure knowledge. 2) Learner-instructor interaction relates to the assistance, counsel, organization, stimulation and support that the instructor provides to the learner in constructing new understanding of the content. 3) Learner-learner interaction is a kind of "interaction between one learner and other learners, alone or in group settings, with or without the real-time presence of an instructor" (Soo & Bonk, 1998).

In addition to the three types of interaction identified by Moore (1989), many researchers emphasize learner- to-self interaction as a fourth very important component in learning: 4) Learner-self interaction: participating in an internal dialogue with oneself. While some researchers emphasize the importance of learner-learner interaction, minimizing the importance of the time allocated to self-reflection during online education (Soo & Bonk, 1998), others note the importance of the inner-dialogue system, suggesting that the development of self-regulatory skills is vital to independent learning and instruction (Savery & Duffy, 1996).

All four types of interaction are vital for distance education, although each type may be most appropriate for different tasks and for learners at different stages of development (Moore & Kearsley, 1996.) An instructional design theory can help us make this determination.

Based on the literature it is clear that interactions have instructional value and that there are many ways of fostering such interactions in distance education environments. However, this literature falls short of being *prescriptive* in nature because little attention is paid to the situationalities in which the methods may be more or less effective. Nor does the literature address the relationship between the various types of interactions and outcomes. Thus our theory will focus on addressing situationalities in which the methods are best used.

Determine Goals/Outcomes.

Wagner (1997) identified thirteen outcomes of interactions that are relevant to the design of this theory. These include:

- To increase participation and engagement with the learning process
- To increase social engagement with others in the group. To develop communication. To receive feedback
- To enhance elaboration and retention
- To support learner control/self-regulation
- To increase motivation
- To negotiate understanding. To build a team
- To discover
- To explore. To clarify understanding intended
- To gain closure

The development of our theory included an investigation of how these various outcomes were attained through the four types of interactions.

Develop Methods, Strategies and Tactics.

This theory focuses on the use of four methods of interactions: learner to learner, learner to instructor, learner to content and learner to self.

Determine Conditions/Situations.

Situations are "aspects of the instructional context that influence selection of methods" (Reigeluth, 1999, p.8). If any element of the situation changes, the instructional methods may need to be changed as well. Situations have two parts: instructional conditions and the desired outcomes of instruction. Instructional conditions include the nature of what is to be learned (learning outcomes), the nature of learner, the nature of the learning environment, and the nature of instructional development constraints.

According to Reigeluth (1999), the desired instructional outcomes include the level of effectiveness (how well learning goals are attained), the level of efficiency (effectiveness divided by cost and time), and the level of appeal (extent to which students enjoy the instruction).

Our findings from the formative research of the theory enabled us to identify in which conditions and situations the methods of interactions worked.

Methods: Phase 2

In Vivo Formative Research for a Designed Case

Phase 2 of the study involved formative research of the theory. Formative research was done by a review of the literature, expert evaluation and through a field trial. A review of the literature was done to support the optimal participant interaction process around which the theory was developed. Expert evaluation of the theory was done by the instructor of the course used as the designed case study. Finally, a field trial was conducted with the course as it was taught during the summer of 2001.

Formative evaluation of the designed case was conducted as a field trial. The purpose of the formative evaluation was to identify and remove problems with the instructional design theory (Reigeluth & Frick, 1999; Thiagarajan, Semmel, & Semmel, 1974). This took place in the summer of 2001 as the course was being taught. An instrumental case study approach (Stake, 1995) was used. Stake describes the purpose of the case examination as being to provide insight into an issue or to redraw a generalization. Though a case study focuses on a single case, the researchers can construct a hypothesis for generalization by close observation of the case. The case plays a supportive role, and it facilitates the researcher's understanding for more general situations.

Course Context

The instructor, an associate professor in the department, and the associate instructor, a doctoral student, participated in the design and development as well as the implementation of the course. This is the first time the instructor and associate instructor had taught a Web-based course. However, both were very familiar with the content of the course, as the instructor had taught the residential version of the course many times. Nineteen graduate students completed the fourteen-week graduate course during a summer session. Among the nineteen students, eight students were part of a cohort group that had begun a Web-based Master's degree program two semesters earlier. Thirteen students had taken distance courses prior to this one.

The fourteen-week course was organized into eight units plus an orientation unit. Each student was required to participate in two team collaborative activities but could choose whether or not to work in teams for additional projects. The maximum number of team activities a student could participate in was five. The students were given seven assignments total: they were allowed to choose to work on the assignments either individually or in a group.

Data Collection

Data for formative evaluation of the course as part of the formative research on the instructional design theory was collected as follows. The researchers informed course participants that a new instructional design theory concerning interactions was being used for the course. This information was distributed by means of the human subjects consent forms used to obtain participant permission to have their online data be used in the study. Sixteen out of the nineteen students in the course agreed to participate in the study.

Data was collected from multiple sources including two Web-based surveys, interviews and observations via document analysis of the course transcripts of communication, learner reflections and completed assignments. The first Web-based survey was distributed after the first half of the course and the second after the conclusion of the course. Telephone interviews were conducted after the conclusion of the course as well. Eleven students completed the first survey and thirteen completed the second. Eight students participated in telephone interviews after the course ended. Both instructors were interviewed half way through the course and again at the end of the course. In addition to the surveys and interviews, transcripts of the discussion forums, class e-mail, course assignments and feedback, learner reflections and chat transcripts from the Web based course were downloaded from the course.

Data Analysis

Data analysis involved data reduction, data display, and conclusion drawing (Reigeluth & Frick, 1999). First, the researchers worked independently to identify themes based on methods and strategies of the instructional design theory. They then categorized these themes by the instructional method or strategy for which it was intended (English, 1992). After closely reading the data, the two researchers reviewed the categorized data to identify which method or strategy had received the most comments. These comments were then examined by both researchers to identify aspects of the method that were receiving comments by the participants.

The findings from the data were then displayed by placing the categorized data into a matrix, which illustrated relevant situational characteristics. Finally, conclusions were drawn regarding specific recommendations for theory improvement.

Findings

Interaction: Learner to Self

In the beginning of the course, the learners were asked to share their expectations of the course, to post an initial personal theory of learning, to identify criteria for usefulness of learning theories and to post initial reactions to general statement about learning. The goals of these activities were to support learner control and self-regulation as well as to activate prior knowledge. The data revealed that these adult learners have rich resources of prior experiences to their learning. These adult learners valued instruction that is personally relevant to them. It seems to be very important for the instructor to identify the prerequisite skills, knowledge and the needs of individuals before and during the instruction.

As learning activities, learners completed individual as well as team thought activities requiring application of the learning theories to practice. The learners were also asked to participate in whole class discussions on the unit topics. The goals of these activities were for the learners to discover, explore, clarify and negotiate understanding as well as enhancing elaboration and retention. Findings showed that the learners were interested in discussions and assignments that were relevant to their lives and needs.

For reflection on learning, the learners were required to complete self-reflections after each project. They were asked to reflect upon what resources they used to complete the projects and how their understanding changed during the unit activity. At the end of course, learners revised the initial personal theory of learning and instruction from the first week and also participated in a final reflective discussion. These activities supported learner control and self-regulation as well as providing closure. They provided opportunities to create a synthesis framework in which to place the theories and the self-reflections were helpful in fostering metacognitive skill development

Interaction: Learner to Learner

The learners participated in many activities throughout the course building teams and increasing social participation and engagement with learning process. For orientation, an informal icebreaker activity provided a chance for learners to get to know each other. Everyone in class including the instructors was required to post eight nouns that best described themselves. The three most commonly mentioned words in this activity were 1) teacher/educator, 2) learner/student and 3) parent/grandparent. The high frequency of these words revealed the important characteristics of this group of adult learners: many of them were involved in authentic situations of learning and instruction in their everyday lives. The class was also asked to post their personal profiles and digital photographs. This helped building a sense of community.

One of the main activities for fostering learner to learner interaction was collaborative team tasks for the unit assignments. By providing choice in the scheduling of collaborative activities as well as the number of group activities to participate in, the course supported learner control and self-regulation. Because these adult learners had extremely busy schedules, the learners felt that two weeks should be the minimum time frame for collaboration. Having project deadlines on Mondays proved to be helpful for these learners since it provided the weekends for them to complete the tasks. For teamwork, the learners were required to provide feedback on the contribution of team members after the completion of projects. It served the purpose of providing feedback and closure as well as building the sense of a team. For the tools the team used, they used different tools for different purposes. Most used initial chats for the decision making process and found them very useful. Twelve out of 13 students indicated in the second survey that they were satisfied with the amount of student-student interaction in the course. Only eight out of 13 indicated they were satisfied with the amount of student-instructor interaction. Nine out of 13 chose to work in groups again for the second half of the course. Of the four who did not choose to work in groups, two participated in interviews. They indicated that their reason for not working in groups was primarily due to busy work schedules and that they wished they could have participated more in group work.

The learners were also asked to facilitate the whole class discussion by choosing to be either the "facilitator" or the "wrapper" for the unit discussion. This activity increased the engagement with the learning process as well as supporting learner control. Instead of having instructors responding every posting to the discussion, the peer facilitation generated a more student-centered atmosphere. The facilitator role presented a new perspective each week and some of the facilitators took on additional roles in the discussion, such as the devil's advocate, to purposively challenge the peers' statements.

Peer to peer responses were also encouraged throughout the course. The learners were asked to comment regularly on others' postings. Many learners felt the heterogeneity of experiences in the class, the great stories and advice from others' experience was tremendously helpful. They said the multiple perspectives resulted in deeper learning.

Interaction: Learner to Instructor

The primary goals of learner to instructor interaction were to build communication, support learner control and self-regulation, and to provide feedback. They also appreciated instructors periodically checking in on teams' progress and whole class discussion. At times when the topics of whole class discussions would drift away from the theory being discussed, the instructors' guidance and redirection proved to be helpful. Learners also appreciated instructors' participation for the sense of "presence". The learners mentioned that they benefited from instructor feedback that focused both on strengths and areas of improvement. In Web-based environments, where tone is not apparent in writing, increased care is necessary when instructors formulate criticisms.

Interaction: Learner to Resources

Learner to resources interactions were used to present new information, increase engagement with the learning process as well as to support learner control. Because learners access new information at their own pace, they rely heavily on the course Website and resources for all information. In an online environment, it proved to be efficient to provide additional Web-based resources to supplement the text. One of the most important findings was that learners felt that having models or examples of expected work were extremely helpful and they wanted to see more of those. They pointed out that they really liked having examples of good whole-class discussion postings provided at the start of the course. They wanted to have more guidelines for collaborative assignments, more specific grading rubrics and more advice for successful online collaboration. The findings showed that the instructors should be careful not to make many assumptions regarding "Web-course literacy" on the part of the distance students. More time and effort were required than in residential courses, especially for the first time distance learners.

Conclusion

This study presents the guidelines for when and how the four types of interaction should be used to achieve the various learning outcomes. By providing a deeper understanding of the adult learners in a distance course, this research indicates that the all four types of interaction are important methods of instruction in a Web-based learning environment. The findings showed that the adult learners appreciated the variety of assignments and a sense of learner control provided by a balance between flexibility and structure of the course. Providing instruction relevant to the prior experiences and knowledge of these adult learners also played a great role in fostering interactions. Given the appropriate guidance and support, the learners preferred to work on teams. When the experience was positive, it established a sense of community and enabled a deeper level of situated cognition.

For further research, it would be useful to explore the dynamics of collaborative works in Web-based learning environments: the content and discourse analysis of a successful team's experience as well as criteria for good participation and facilitation in class discussions. Greater insight would be obtained by more detailed exploration of the learning outcomes and methods of evaluation specific to adult learners in Web-based learning environments.

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Exploring Innovations in Personalised Teacher Education

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Abstract

This study adopts innovate self-study research methods (Bullough& Pinnegar, 2001) to explore the effectiveness of teachers' use of self-referenced activities designed for the development of personal teaching portfolios. Two short video presentations, along with participant and instructor workshop guides provided necessary instructions and materials. Personalized classroom design and photo activities were completed within a teacher education workshop aimed at developing personal portfolios. Data collection included written/oral activities and videotaped group discussions. Four criterion selected teachers engaged in activities that required the re-design of classroom activities and the use of personal photos. Results indicated that all participants were able to successfully redesign conventional classroom activities as constructivist classroom activities. Photo activities were found to be motivating and relevant to all participants. Recommendations offer insights into future constructivist learning research, the potential benefits of self-referenced knowledge, and the use of self-study research methods.

Educational reform programmes being carried out throughout North America are aimed at offering instruction that accommodates all learners and highlights lifelong learning. There is widespread rejection of the teacher represented as one who delivers knowledge to passive recipients. Instead, learning is viewed as a self-regulatory process involving individual meaning construction and processes of social activity, discourse, and debate, (Twoney and Fosnot, 1996). Current reforms derive theoretical grounding from constructivist learning theory (Lueddeke, 1999). Based on constructivist theory, advocates of educational reforms recommend the use of educational portfolios as an alternative means of learner evaluation for lifelong learning.

Educational portfolios are recognised as a multi-media educational tool for accommodating all learners (Martin, 2000). Educational portfolios are commonly viewed as purposeful collections of work selected by learners to demonstrate learning progress and achievements over some period of time. Portfolios consist of on-going work efforts, students' reflections, self-evaluations, and rationale for work selected that make it up (Cushman, 1999; Daiker, 1992). To this end educational portfolios have been identified as a useful evaluation tool capable of informing on long-term learning growth and formative evaluations. For instance, Durst, et al. (1994) consider portfolio evaluation as a "fluid form of assessment that requires negotiation not a calibrated form of assessment that moves away from absolute judgements about writing into more shaded, nuance understandings of difference" (p. 287). This view of assessment captures what Guba and Lincoln (1989) refer to as "fourth generation evaluation", evaluation which explicitly acknowledges the socio-political, unpredictable, and constructivist nature of evaluation as a teaching and learning process.

Two characteristics of educational portfolios highlight their widespread appeal to the educational reform. First, educational portfolios can cater to a diversity of learner styles by allowing students the opportunity to document learning in the media they are most comfortable (Barrett, 1994). Second, portfolios, specifically, electronic portfolios allow for learners to explore multiple media (i.e., text, graphics, animation, images, audio clips, video clips, etc.). This has importance for educators as well as instructional designers because of the educational reform's commitment to all learners and the educational tools that have been recommended for fulfilling these commitments.

The introduction of constructivist informed educational portfolios marks a departure from conventional educational methodology. Informed by constructivist theory, this study is framed under the assumption that teachers can not model good educational practice when they have never had the opportunity to experience and relate it to themselves. The rationalale for this study is structured around issues in multiple media, advances in image and art-based inquiry, and the signification of the concept of self-referencing in advancing teacher education.

Literature Review

What impact has media research had in education?

Theoretical grounding for multiple media (multi-media) and multiple intelligences comes from various sources. Symbol Systems theory posited by Salomon (1974) presented arguments based on media research to explain how different symbolic forms of representation (e.g., pictorial, verbal, numeric, graphic, etc.) require that individuals use different mental processes. Salomon (1997) adds, "Being part and parcel of the information itself, media's symbolic forms of representation influence the meanings one arrives at, the mental capacities that are called for, and the ways one comes to view the world". In other words, each medium conveys content via inherent symbol systems which, in turn, affects the meaning derived.

Research on multiple media in education covers a wide range on topics with relatively focused objectives according to Salomon (1977). These objectives include: (a) to test instructional effectiveness of a medium or technology, (b) to investigate psychological effects of media and technology on individuals, and (c) to enhance the practice of education by providing and evaluating media and materials. The greatest challenge in multiple media research has been to convert media's potential to fulfill educational purposes. Criticisms in the field come from opposition to media-based instructional aims, such as instruction in visual literacy and media awareness (Snow, 1970: Cassidy and Knowlton, 1985). One potential problem of media research is the lack of solid evidence of how symbolic forms can be used to enhance diverse educational practices. This is a problem of association in my view.

In a similar vein, Gardner' s Multiple Intelligence theory (1983) asserts that different intelligences represent not only different content domains but also learning modalities. Under this framework, multiplicity in cognitive processes gives rise to multiple forms of representation that influence individuals' understanding of phenomena. Recognition of multiple forms of representation has been connected to diversity of personal learning styles (Gardner, 1993). There is, however, a challenge when dealing with intelligences that are difficult to represent (i.e., affect) and are considered only placeholders in contemporary educational psychology research. One potential problem is a lack of research that succeeds in drawing out mental processes theorised about but never observed. This is essentially a problem of representation in my view.

Problems of association and representation call into question whether or not different symbolic forms that call on different cognitive capacities affect the way individuals represent the world to themselves in some meaningful and lasting way that could provide leverage for advancing education.

Can image and art-based inquiry make a difference?

Image and art-based techniques are becoming increasingly popular in the field of education. Image and art-based techniques initially used for therapy are becoming part of a recent trend in educational research (Davis & Butler-Kisber,1999; Prosser, 1999). Art-based research has been used to enable individuals to externalize conflicts and remove mental blocks (Davis & Butler-Kisber's,1999). The authors treat the collage as a functioning form of analytic memo to complement other forms of representation by providing a means to self-critique. Cartoons and other types of visual images have been used to reconstruct and reify perceptions of public narratives through analysis and interpretation (Warburton, 1998). Warburton's own semiotic approach to cartoons treats cartoons as public pictures or cultural artefacts, defining meaning according to how the image is produced and the intended use of the image. This type of work has typically been used to enrichen educational practices but could contribute as well by extending the *breadth* of representational forms beyond what is presently studied in educational research.

In another domain, image-based techniques have offer a unique capacity to inform on processes difficult to access by other means. Prosser and Schwartz (1998) discuss the use of photographs within qualitative research to probe for personal knowledge:

> Through our use of photographs we can discover and demonstrate relationships that may be subtle or easily overlooked. We can communicate the feeling or suggest the emotion imparted by activities, environments, and interactions. And we can provide a degree of tangible detail, a sense of being there and a way of knowing that may not readily translate into other sy mbolic modes of communication. (p. 116).

Image-based psychoanalytic techniques and other forms of memory work employed in therapeutic and transformative practices also extend the *depth* of representational forms beyond what is presently studied in educational research by providing researchers and educators with useful insights on how to overcome problems of representation by uncovering mental processes previously hidden.

What is self-referenced knowledge and its role in learning and research?

Entire branches in philosophy are directed to issues of knowledge representation, reference, and meaning formation. Without digressing into lengthy discussion, representing objects and states of affair is considered a part of the mind's general capacity to relate an individual to the world. Consequently, the knowledge representations individuals are capable, in what context they occur, and how they occur are instrumental in informing on learning. Equally important is where representations point, there referentiality.

This study puts forth the notion that what distinguishes image and arts based research in the domain of education lies largely in their self-referencing quality. Self-referencing is employed uniquely here to describe the relation of the representation perceived by the individual who conveys it to him/herself. Unlike many learning contexts which involve the construction of knowledge, acquiring self-referenced knowledge also implicates the learner's self-concept, resulting in greater possibilities for conceptual associations to be made and higher-order thinking to be achieved. Self-referenced knowledge involves being able to recognise oneself in what one does. This is exemplified by answering questions like: Does this experience relate to who I am and how is this experience important to me personally?

How does self-referenced knowledge make a difference?

Failed attempts to integrate constructivist oriented educational reforms and educational portfolios is one area where the absence of self-referenced knowledge is having an influence. Where teachers have little or no personal experience with educational portfolios or their assessment, portfolio training materials have been implemented for teachers that focus on the development of professional knowledge (Ruskin-Mayher, 1999; Silva, 2000). Results have indicated, however, that this fails to get at personal knowledge and skills development (Au, 2001b; Frederick, McMahon, & Shaw, 2000, Silva, 2000). Wadlington & Partidge (2000) comment "Before teacher educators can ask preservice teachers to use journals, self-assessment, peer conferences, portfolios, observations, and so forth, they must first model these techniques themselves." Similarly, Cushman (2000) speculates, " What if educators presented portfolio evidence of their own learning and growth? What if they tried to show in concrete ways how that growth affects student learning? Doing so, many are coming to believe, might shed new light on some of the most intractable questions in the current debate about school change."

Consequently, there are a number of questions that have not been fully explored. First, do teachers perceive a need for personal development to be able to successfully adopt this new form of classroom instruction? Second, can the participation of self-referenced practices advance teachers' understanding and comfortability with current educational reform policies?

What is missing from teacher education?

The study posits that teacher education should not only cultivate professional expertise, but also self-referential expertise. Understanding ourselves as educators is of fundemental importance. Being able to explain our reasons for doing something or choosing this way over another brings additional meaning to what we are doing (Connelly & Clandinin, 1999, p. 11). Portfolio training materials do exist for teachers that focus on the development of professional knowledge (Ruskin-Mayher, 1999). Professional knowledge is comprised largely of step by step instructional procedures for teaching reflective processes, self-assessment, and peer reviewing within a classroom setting, along with sample activities, and evaluation rubrics. This does articulate the importance of personal experience and skills development considered essential to effective instruction (Silva, 2000). How can teachers engage in reflective processes and self-evaluate when they have never had the opportunity to experience it themselves in their own learning? How can teachers model good educational practices when they have not personally experienced what they are attempting to model?

Rationale

The rationale for conducting the following study stems from longstanding work in image and art-based clinical research exploring psychological processes not accessible by other research methods through self-exploratory techniques (Weiser, 1993). Weiser (1993) demonstrates the success of photo-therapy techniques in helping individuals to represent personal knowledge not directly assessable. Such therapeutic techniques offer innovative avenues of exploration through their power to use images to invoke personal knowledge. In addition, art and image-based approaches to learning offer the potential to leverage educational reform efforts by contributing research knowledge of multiple representational forms. To this end, the self-referenced knowledge approach has been developed to contribute to teacher education in a way consistent with advocated reform ideas. This innovation was tested by evaluating its effectiveness in improving teachers' attitudes and abilities to apply constructivist concepts and portfolio processes to professional practices. The self-referenced dimension of learning was highlighted throughout the workshop instruction by appealing to the power of personal meaning formation, and self-reflection through personal photo use and its role in constructivist informed learning practices.

The main objective was to identify challenges and determine whether self-referenced knowledge can be an effective teacher education intervention for advancing expertise and improving attitudes of constructivist informed educational portfolios. To this end photo-therapy techniques were adapted to a teacher education workshop aimed at developing personal portfolios by: 1) appealing to the power of personal experience, and 2) exploring the use of self-referenced knowledge to advance teacher expertise.

Method

The study conducted was a qualitative *case study* of a teacher workshop. Merriam(1998) defined case study as," an intensive, holistic description and analysis of a single instance, phenomenon, or social unit" (p. 21). The study focused on the experience of learning from the integration of participants' perspectives and is based upon a constructivist orientation to qualitative research. The guiding premise for conducting the case study was that understanding arises most meaningfully through open-ended activities and ongoing exchange between all participants. Qualitative methods used to gather information follow a constructivist paradigm aimed at reflecting the multiple perspectives constructed by those involved in the inquiry, including the researcher (Lincoln & Guba, 1985). This method was chosen for its capacity to provide in depth evaluations for generating holistic lifelike descriptions, illuminating meaning, and communicating tacit knowledge (Guba and Lincoln,1981, p. 375). This type of description is especially useful when dealing with contextually sensitive image-based data:

> Photographs get meaning, like all other cultural objects, from their context. Even paintings or sculptures, which seem to exist in isolation, hanging on the wall of a museum, get their meaning from a context made of what has been written about them, either in the label hanging beside them or elsewhere, other visual objects, physically present or just present in viewers' awareness, and in discussions going on around them and around the subject the works are about. (Becker, 1998, p. 88).

The Role of the Researcher

Prosser and Schwartz (1998) indicate, "Before qualitative researchers begin to mine a site for the data it holds, we need to consider how we present ourselves to our subjects" (p. 119). The researcher's in data collection is a participant-researcher perspective, where workshop activities include researcher participation and data collection includes the researcher's perspective as well as those of the other participants. This insider approach creates an open and sharing environment for discussion. The methods of data collection chosen are designed to empower participants and foster a sense of personal ownership over data.

Data Collection

Participants in this study were educators who have taught in Quebec. Four participants, not including the participant-researcher, were used in this study (N=4). The number of participants falls into the acceptable range for field testing of instructional workshops. The study was carried out at Concordia University in the spring of 2001. Data was collected directly from the participant researcher and other participants through the following: Teacher Portfolio Questionnaires (TPQ), group discussions and oral activities transcribed from videotape, and group writing activities.

Validity and reliability of instruments

In qualitative case studies, validity and reliability issues are dependant on the researchers ability to convey the trustworthiness of research findings and the researcher's success at providing a convincing description of the action or event taking place (Merriam, 1998, p. 198). Firestone (1987) points out, "The qualitative study provides the reader with a depiction in enough detail to show that the author's conclusion 'makes sense" (p.19). Internal validity refers how much the research findings match reality but reality is holistic multidimensional, ever-changing, researcher influenced under a qualitative research framework (Merriam, 1998, p. 202). According to Lincoln and Guba (1985) human beings are the primary instrument of data collection and measuring internal validity depends how closely reality can be approximated by close observation and inquiry.

Following Merriam (1998), multiple steps were taken to ensure a high degree of internal validity in the present study: triangulation, participatory research method, inter-rater reliability. First, multiple sources of data collection were used to provide an adequate diversity of finances to triangulate. Second, the reseearcher participated in the study and all activities. Third, inter-rater reliability was employed by having a selections of activity responses scored by an outside scorer.

Issues of reliability were also important considerations in this study. The notion of reliability is viewed as the consistency of the results from the data collected (Lincoln and Guba, 1985, p. 288). A high degree of reliability was secured through explanations of data collection and interpretative steps (Lincoln and Guba, 1981). Finally, efforts were made to provide thick descriptions and participant commonalties (LeCompte & Preissle, 1993) in order to allow for the possibility of generalisations to be made.

Data Analysis

Data analysis was based on assumptions stemming from a constructivist framework which highlights: the importance of the individual experience, the wide range of perspectives possible, and the public sharing of meaning. Following Maxwell & Miller (1996) two types of qualitative data analysis were employed: paridigmatic and syntagmatic. Paridgmiatic relations are determined based on their similarity or difference in meaning, whereas syntagmatic relations are concerned with the relationship of entities within the context. In the present study, questionnaire and activity results are paridigmatically coded with a themantic classificatons derived from the presentation material. Contextualizing strategies in the form of narrative summaries and direct quatations were applied to discussion and oral activity data. To this end, I examined perceived abilities and attitudes towards portfolios, instructor profile, group results on constructivist design activity, group results on photo portfolio activity, and discussion results. In addition, I examined my own beliefs and participation in the study conducted.

Findings and Interpretations

Teacher Portfolio Questionnaire (TPQ)

All participants received the Teacher Portfolio Questionnaire (TPQ) prior to the workshop field test to complete (Note: all names are fictitious to preserve the identities of those involved). The questionnaire was designed to assess level of prior experience with and attitudes towards portfolio use. Both paridigmatical and non-paridigmatic types of data The results of each participant are summarised to provide participant profiles:

> *Len* is a doctoral student in an educational technology program. He has two years of teacher assistant experience in Quebec and in currently involved in project collaborations within the educational reform. He has two years experience using art and writing portfolios and enjoys their capacity for demonstrating learning growth. What he enjoys least is how poorly they are been used for evaluation in educational settings.
>
> *Bob* has taught for 35 years. He has used digital and photographic portfolios. He perceives his own abilities with using portfolios in teaching as ranging from excellent to fair. What he likes most about using portfolios in learning activities is the variety. What he likes least is that they are difficult to evaluate from a criterion standpoint.
>
> *Vicki* has taught for 2 years. She has used math, art, and language arts, portfolios. She perceives her own abilities with using portfolios in teaching as ranging from very good to good. What she likes most about using portfolios in learning activities is that learners can see their own work. What she likes least is that they are difficult to evaluate.
>
> *Candice* has taught for 27 years. She has used math, art, and language arts, portfolios. She perceives her own abilities with using portfolios in teaching as ranging from very good to good. What she likes most about using portfolios in learning activities is that learners can see their own work. What she likes least is that they are difficult to evaluate.
>
> *Betty* has taught for 15 years. She has used writing and art portfolios. She perceives her own abilities with using portfolios in teaching as ranging excellent to very good. What she likes most about using portfolios in learning activities is that they are flexible. What she likes least is that they are time consuming.

All participants rated their ability with using portfolios as excellent to fair. Experience with portfolios ranged from participant to participant from the types used and the number of years using them. The likes and dislikes for using portfolios in teaching varied from participant to participant, however, three of the four participants shared a dislike for the difficulty of assessing portfolios.

Instructor profile analysis

Discussion data and reflective field notes from the instructor were analyzed for indicators of belief and attitude. Categories extracted include: personal belief, optimist, and motivator.

Personal Belief Len, the instructor and designer or the workshop field test had his own views on life and learning. He believed that no amount of knowledge would compensate for the need to understand how we are as humans whom possess a unique relation to the world, to each other, and to themselves. He was sensitive to issues of personal meaning, and letting people determine their own educational direction:

> Going towards some method of learning and evaluation that everyone can get something out of--something that your allowed ownership of for one reason or another that you can develop into something. Moving towards portfolios could be a really good way to accomplish that if it is done correctly (discussion extract from Len).

Optimist During the workshop instruction there was some apprehension among participants as to what professional knowledge could be gained from engaging in personalised learning activities. Participants were not at all sure how teachers could both satisfy personal likes while making sure that learners acquired necessary formal knowledge. Len's approach was one of optimism and openness:

> There is some sort of formal knowledge that is important to acquire, but it does mean that you have to do it the same way. It would be interesting if everyone's activity that they redesigned suited them best and their style and the things that they like. So a lot of the objectives or redefined competencies end up being accomplished, but in a way that is more enjoyable for the teacher and hopefully more enjoyable for the student (discussion extract from Len).

Motivator Len found himself in the role of motivator and animator in the workshop. Given the open-endedness of activities, participants were unsure of the appropriateness of their responses. This was revealed through comments made by participants. Len facilitated the discussion by having participants share their work. He attempted to provide positive feedback by summarising participants work and highlighting positive points:

> That's kind of a wonderful constructivist activity. They're engaged in a social activity. They are going beyond the information given discovering things maybe the instructor didn't even intend. They are critically thinking by making a evaluation in their groups. It requires them to work together individually and to communicate effectively in a hospitable and democratic fashion (discussion extract from Len)

Together, aspects of the instructor's role were found to be extremely relevant and did have an effect on the participants by being optimistic and providing motivation. This connects with attitudinal and ability factors identified in the group discussion (i.e., motivation, perceived integration challenges, and transfer of learning). One possibility is that the instructor played a vital role in helping participants overcome resistance, rationalise challenges, and re-create their learning (learning transfer).

Constructivist Design Activity

All four participants participated in an activity to redesign conventional classroom activities as constructivist classroom. Findings are summarised in the table below:

Table 1: Constructivist Design Activity

Conventional Activity	Constructivist Activity
Conducted a spelling bee with two teams	Redesign of Spelling Bee. Instead of asking them to form competitive groups, I would probably have them: -write their own pieces and then in dyads have them try to correct their spelling. -peer proof reading using dictionaries and asking others -this way the spelling becomes more personally meaningful. (Candice)
Lectur*e*	Redesign of Lecture: -Hand out typed version of lecture in 4 pieces. -request each student make a mind map of the words (ideas) and turn in the piece they got. -duplicate so that everyone has a complete set. (Bob)
Teaching math classification on blackboard.	Redesign Teaching math classification on blackboard. -Introduction with real objects that are familiar to kids (a shoebox ,marbles, wood blocks etc.). Name the objects and divide into groups; group A 'squares' , group B 'circles' and group C 'rectangles. -Groups of kids go on a square, rectangle, or circle hunt and bring objects to a specified spot for examination and decide in their smaller groups whether what they found is accurately classified. -Then the objects are examined by the larger group. (Betty)
Puzzle Pieces 5-yr olds put together a simple puzzle.	Redesign of Puzzle Provide children with blocks (3-D) and have them create their own structures. (Vicki)
Teaching Fractions I gave examples of math from text book and then a demonstration (divide a plate into quarters)	Redesigning Teaching Fractions -Bring fruits in and have class break into groups -Groups cut them up in pieces and present their hypotheses about the dividing exercise and come up with a new way to do it (the fraction exercise.). (Len)

Written activities were rated for the presence of constructivist learning competencies delivered in the presentation. The instructional aims at the beginning of the workshop were to demonstrate three constructivist learning competencies. A scoring template used by the researcher was constructed directly from the workshop material to score the presence or absence of constructivist competencies. Findings indicated that all participants incorporated three constructivist learning competencies into their written responses.

Table 2: Percentage of Participant Competencies Achieved

Participant	Percentage of Competencies
Bob	100 %
Vicki	100 %
Candice	100 %
Betty	100 %

Although all participants were able to fulfil the instructional aims, the activities themselves were not perceived as easy. None of participants found the workshop overly easy. Comments indicated participants found the activities relatively challenging: " This is hard to do (Betty),'' ''I am not a conventional teacher. I am finding this one hard (Candice),'' and ''This is tough (Vicki)." This can be interpreted as an indication participant success was not due to the simplicity of the activities chosen. Another possible interpretation is that participants had high levels of personal interest in the material and were highly motivated to learn.

Photo Portfolio Activity

Completing *the photo activity* required the demonstration of the following portfolio competencies: selection, reflection, and peer sharing. Participant responses are presented as direct quotes to preserve the completeness of description and to avoid possible researcher biases that arise from de-contextualizing responses. A scoring template used by the researcher was constructed directly from the workshop material to score the presence or absence of portfolio development stages. Findings indicated that all four participants were able to meet the workshop competency objectives to perform three competencies of personal portfolio development and incorporate three stages of portfolio development into personal learning. The nature of the responses was unique from case to case.

***Candice*.**

Candice had chosen a photo of herself sitting on a patio on a summer afternoon. The patio was filled with guests and the guests were dressed for a formal occasion. In the photo a man was turned to her as she looked in his direction:

Candice: ''One of the things I said about this picture in my own comment on what it revealed to me as a learner seemed to show my intense nature There is a look in my eyes and the way that I am sort of judging and gauging things and reactions. Now can I read yours" (Selection, Reflection)

Candice: '' One of the things Betty said was it reveals awareness of ability to communicate with facial expressions so she saw something in my face as well, which is an interesting comment. So now if I wanted to write more about that picture I would use that comment which I might do. . ." (Sharing)

Bob:" You also have quite a bit of body language in there" (Sharing)

Candice: " Yes I do and I suppose If you were gonna write about me you would probably mention that." " In the upper box Betty said that this person looks flabbergasted. What are you talking about is that I am not interested and it is true. If you look at this my body language it is saying I don't want to talk to you. This happens to be at a family wedding and this particular individual I was being as polite as I can but my body language is . ." (Reflection)

Candice's own interpretation is expanded when Bob picks up on the way she had her legs crossed in the photo. This was one aspect that Candice did not notice and something that, one stated, she was able to build on and tie into another participant's written comments on the same photo. This could be interpreted as a good example of how individual reflection can be expanded upon by others' perspectives.

Overall, photo portfolio activity findings were positive. Interpretations of photo portfolio findings revealed the following:

1) Individual reflection can be expanded upon by others' perspectives.
2) Individual reflections can be complemented by confirmatory comments from others.
3) Photo activities are not exercises that are detached from learners, but rather, are authentic and related individuals lives.
4) Personal photo activities can become socially motivating and relevant to others.
5) Photo activities can acquire a meaning beyond what is contained in the photo itself and connect with events and people independent of the photo.

Group Discussion Findings

Discussion results were transcribed and coded thematically. Categories extracted revealed the following trends in participants' responses: 1) motivation 2) perceived implementation challenges, and 3) transfer of learning.

Motivation Findings indicated a lack of motivation towards the constructivist informed educational policies currently being implemented. This was revealed through discussion:

> Then you can have constructivist practices or constructivist activities, but you're never gonna have real constructivism witch is why in my opinion it makes it very difficult for the MEQ to say we want everything to be constructivist (discussion extract from Candice).
>
> It seems to me that probable this reform is not legitimate, that for a reform to be legitimate the stakeholders have to discuss it and come to some understanding about it. Then you can bring it about. If you just have top down imposition of something. If people have low power they will comply with it superficially. If they have high power they will go on strike or something like that. Unfortunately the teachers are mostly in a low power situation. However the parents are not. The parents are in a high power situation so they can effect it (discussion extract from Bob).

Implementation challenge Findings also indicated a perceived implementation challenge for widespread constructivist informed educational policies:

> I just have a question about the constructivist Ideas for education. I think the biggest challenge for constructivist philosophy is the parents. They're going to come into the classroom, and they want to know what is going on here. You have kids running around the place doing whatever they want. I am taking my kid out of this school and putting them in another school. I can see the parents really reacting that way and how do you handle that. I think we have to put the parents in there somehow (discussion extract from Betty).

Transfer of Learning Discussion results indicated a transfer of learning from the constructivist activity to the portfolio activity. There were instances where the participants integrated attributes into the personal photo activity that drew from social and critical constructivist characteristics experienced in the first activity: This was revealed through discussion:

> The other factor is the photographer. The decision a photographer makes about how to frame You, where to put you in a picture." " I am just trying to say that depending on the photos you choose, some photos do not necessarily have that capture of you. So if you went to a professional photographer to get a nice head shot for a movie you are not going to look like you. So if I give a picture on how someone can dress up a photo of you the feed back is really about the photo too. You choose it but there is something about the photo that you have to factor in (extract from Betty).

Also, the constructivist characteristic of communication and morality became a part of the photo activity as exemplified by Bob's concern " This is an intrusion, I mean when I write something like that to some extent that is an intrusion into Betty's world so we have to have a situation where there is a reasonable trust or in this case, the okay when someone can intrude in on my world."

The categories that emerged from the analysis can be best interpreted by recognising their attitudinal and ability components. Accordingly, participant motivational factors and perceived implementation challenges can be interpreted as attitudinal indicators. Scepticism concerning the MEQ's capacity to succeed and questioning the legitimacy of the educational reform can be interpreted as attitudinal indicators of *resistance*. Similarly, a perceived lack of parental involvement and teacher ownership can be interpreted as attitudinal indicators of *rationalisation*. Participant ability factors can be interpreted as ability indicators. Being able to integrate aspects of the constructivist activity into the personal photo activity can be interpreted as an ability indictors of *recreation.*

Together, the attitude and ability indicators reveal a different set of threes R's than is traditionally associated with education: resistance, rationalisation, and re-creation. The clearest interpretation from a constructivist standpoint would be to treat resistance, rationalisation, and re-creation as developmental steps in the learning process. This is consistent with contemporary models of professional development where new learning is first met with resistance, followed by a number of additional steps required before accommodation can take place.

Educational Implications

Contribution to educational theory

In the present context, individual participants demonstrated resistance, rationalisation, and re-creation processes with a community of learners. This draws attention to the importance of providing teachers, as advanced learners and professionals, the opportunity to discuss personal challenges and raise issues so that some sort of rationalisation can be achieved. This furthers constructivist theory in education by identifying the impact of personal and social factors within learning contexts.

Contribution to educational research

Having the opportunity to discuss personal challenges and raise issues with others could have considerably impact on individuals' capacity to integrate new learning (re-create). This provides empirical evidence that self-referential knowledge does impact on professional development interventions carried out within groups. The fact that personal photo activities were found to be motivating and relevant offers insights into constructivist learning research, and the use of self-study research methods, which have attracted much recent attention in the educational literature (Bullough & Pinnegar, 2001). Future research will consider how patterns of resistance, rationalisation and re-creation occur in different professional development contexts.

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Digital Television: The Future of Education?

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Introduction

Digital technology has turned a new page for TV Broadcasting. The convergence of television and computer brought about powerful effect to TV viewing experiences. Not only in the TV evolution, but also in the distance education, digital broadcasting combined with the Internet is conceived as a new driving force that will revolutionarily change the mode of learning in the very near future.

ITV program and Web-based instruction have appeared to be the most common ways of distance course delivering in the past one decade. Each of them has different attributes that meet different learners' need. However, many educators believe that the interaction and two-way communications that are required for all learning are not as effective in these two modes as in the face-to-face instructional format due to the limited potential of the existing technologies. Poor or time-buffered images, low-speed transmissions and high costs are part of the obstacles that were experienced by educators in embedding interactivity in the distance education program.

Many educators perceive that Digital Television and technology would possibly improve the current state of interactivity in the distance education due to its advanced features. High resolutions and digital transmission would make the communication much more clear and easier. One possible use of Digital television in education, as Carvin (1998) described, would be enhanced TV, which supplemented by multimedia content to provide interactivity for learning needs. Various contents such as web pages, quick time movies and text scripts can be composed into the framework of course design. However, DTV technology is still in an early developing stage. There is insufficient information and few studies had been done for educators for pedagogical uses. It would be necessary to investigate those potential effects DTV could bring to distance education, and what learning aspects DTV would contribute. This review will explore DTV's attributes, discuss some possible applications for interactivity and the underlying theoretical and research bases.

Discussion

The basic job of distance educators is changing adult behavior (Verduin & Clark, 1991). According to the perceptual theory of psychology (Bills, 1959; Combs, 1959), how individuals view people and the objects and events in their environment will greatly influence how they behave. Verduin and Clark (1991) further explained the theory that "Behavior is a function of perceptions. Perceptions can be consciously or unconsciously constructed through several interactions with the environment." "It is through this construction that they tend to display behavior." Environment is critical to distance learners for behavioral changes, so that learning may occur. In distance education, environment relies heavily on the technologies. Through technologies, distance learners are able to interact with environment, communicate with the instructor and other students. In his "guided didactic conversation" (1989) theory, Holmberg proposed seven background assumptions for Interaction and Communication. He believed that the core teaching consists of interaction between the teaching and learning parties. Emotional involvement in the study and feelings of personal relation between the teaching and learning parties is likely to contribute to learning pleasure. Also, a friendly, personal tone and easy access to subject matter contribute to learning pleasure. Learning pleasure supports students motivation, and strong motivation facilitates learning.

The purpose for learning is to be proficient in a field or fields. Knox (1980) in his theories on adult education suggests that proficiency is a key construct and is actually the capability to perform effectively in a given situation. This capability usually depends on some combination of knowledge (the cognitive domain), physical skills (the psychomotor domain), and the attitudes (the affective domain) that the adult processes. Therefore, to enhance an adult's proficiencies and capabilities to perform and to facilitate learning, educator must place the three major domains at the center of instructional thinking and planning for adults (Cranton, 1989). Consequently, to build adult learners' proficiency in the distance environment, it is essential that the three major domains achieved by the students through an interactive manner.

However, the limitation of technology constrains the interaction and give-and-take processes of learning. When interaction is made less complete due to loss of aural and/or visual stimuli, expressions that might have communicated meaning are lost (Verduin & Clark, 1991). Besides, difficult access to subject matter discourages learning pleasure and lessens students' motivation. Many efforts have been put on the improvement of technology-based learning environment to produce interactive instruction and learning activities. Digital broadcasting comes along with advanced features that many educators aware that might bring about a leap in distance education. A discussion of these features from the perspective of Knox's (1980) proficiency domains and interactive learning is followed.

Video/Audio effects in learning

Audio accompanied by static print materials has demonstrated to be as effective as face-to-face classroom instruction for step -by-step procedural tasks (Wisher and Priest, 1998) as well as graduate education (Burge and Howard, 1990). Similar to audio with static print materials, audio graphics transmits a visual image accompanied by an instructor's voice, usually through audio conferencing to students at remote sites. The students do not see the instructor, but rather attend to content. Audio graphics should result in the same learning outcomes as audio with print materials (Wisher & Curnow, 1999). Both of these two forms support one of the three types interaction occurring in distance education as described by Moore (1989), the interaction between student and content. The type of interaction is most important. In a study that investigates perceptions and effects of image transmission during Internet-based training, Wisher and Curnow (1999) indicated that there are categories of learning for which there is apparently little need to see the instructor, such as learning declarative knowledge or facts. However, there are some learning tasks that instructor's visual clues are required such as training in first-aid procedure or communication skills such as sign language, depending on visual motion cues during instruction (Wisher and Curnow, 1999). In fact, visual images of lesson materials and instructors are both essential depending on different knowledge learning. Instructional or instructors' image can support and facilitate students' cognitive learning domain, according to Bloom's systematic way of viewing cognitive growth (Bloom and others, 1956), from knowledge comprehension, application, analysis, synthesis to evaluation.

DTV is able to transmit lesson content and instructor's image as well as motions. Except for an ordinary image communication, the image will be presented in an aspect ratio of 16:9, which is different from the conventional 4:3. The screen is formatted more rectangular and much closer to the way people see. Image fills more of the field of vision and has a stronger visual impact. Generally, publics consider that a larger and more rectangular screen is preferred by most of the audiences. Besides, DTV has smaller pixels that are close together, so there are more pixels in a space on a screen (4.25:1 compared to NTSC standard). DTV pixels are square, just like most computer monitors, are able to remove image distortion and present a high-resolution image (Cringely, 2001).

But in what degree do student's perceptions and preferences toward video capability relate to learning? Research findings from instructional television indicated that there is generally no significant relationship. In a study by Greenhill, Rich, and Carpenter (1962) that examined preferences for screen size, students are divided into two groups and assigned to small or large screen. The results show that students prefer larger screen, but their preference was not related to achievement in this course. In one other study of the effect of visual display, Johnson and Stewart II (1999) found that more immersive visual display had no effect on gaining special knowledge. However, the size and ratio of screen might have impacts on students' satisfaction to learning experience. Students' satisfaction will have effect on their affective learning domain. Affective domain where receiving, responding and valuing (Krathwohl, Bloom, and Masia, 1964) foster the formation of attitude toward followed learning behaviors.

Audio effect had been found influential to student's affective learning domain. In Kelsey's (2000) study of the interaction in a course delivered by interactive compressed video technology, the most significant and effective barrier to interactions was the limitations and failure of ICV technology. Echoing and squealing noises, as well as time delays and disconnections, inhibited interaction between guest speakers and students. Speech that was mediated through ICV technology lacked the spontaneity and lucid flow that is expected during face-to-face conversion. Students reported that interacting during the live broadcast was problematic because communication delays gave speech a choppy and unnatural sensation.

DTV technology adopts Dolby Digital/AG-3 audio encoding system to broadcast sound. The sound would be much sharper and crispier. DTV broadcasting uses digital high-speed transmission, more consistent the data will stay over distances. Although both analog and digital signals get weaker with distance, while the sound and picture on an analog TV slowly gets worse, the sound and picture on a digital set will stay perfect until the signal becomes too weak. There is convincing reason to speculate that DTV wil3l have positive effects on students' affective learning domain (Cringely, 2001).

DTV and Interactivity

Vrasidas and Marina (1999) in their study of factors influencing interaction in an online course indicated that there are factors directly influence interaction, including learner control, transactional distance, feedback, and social presence. Among the three factors, learner control is central to the notion of interaction. Garrison and Baynton (1987) described that the concept of control consists of three components: independence, power, and support. The proper learner control should be a balance among these three components. To expand more precisely, independence is the degree to which the learner is free to make choices. Power is the abilities and competencies of the learner to engage in a learning experience. Support is the resources available that will enable the learner to successfully participate in the distance education course. Improvement in television delivery methods created new options for distance learners to communicate (Machtimes and Asher, 1996) also might increase the capability of learner control.

Currently, HDTV is the best-known term for digital broadcast TV. When a show is digitally broadcasting on the television, the audience can interact with the content of the show online and get immediate feedback. Yet, the potential for DTV can be greater.

Datacasting

According to the Guidebook to DTV developed by Harris Corporation, DTV will allow broadcasters to deliver ancillary digital data in variety, such as web site materials, multimedia content, program, and non-program related information. DTV is also capable of delivering data hundreds times faster than traditional modem. An enormous amount of content could be sent through airwaves without requiring the user to subscribe to an online service or to have a wired computer connected to a high-speed Internet connection. These are things that traditional broadcasting can never accomplish.

Digital transmission is operated in a way that more data can be transmit, and more types of data could be carried through the same amount of bandwidth because more information could be carried in a digital signal by using MPEG-2 encoder to compress data. DTV broadcasting technology has one-to-many, real-time, high-speed data-delivery channels. Any program created by educators for delivery over digital media CD-ROM, IP web stream can be transmitted to any individual receiver or all receivers in the coverage area. When TV stations are transmitting less demanding signals, greater capacity for datacasting becomes available (Cringely, 2001).

Multi-casting ability

Instead of broadcasting in a high definition mode, Digital TV can be programmed to broadcast in standard definition mode while it multicasts four choices at the same time and the same channel. Some broadcasters, including many PBS stations, have already planned to multi-cast four choices of programs during the day and then switch to high-definition for prime-time. This option offers more choices, make viewing experiences more interactive (Cringely, 2001).

Interactivity? Or not?

Corporation for Public Broadcasting (CPB) conducted a study (1999), "Will TV viewers want interactivity?" to evaluate prototypes of digital public television programming. According to CPB, the prototypes were designed to demonstrate potential interactive techniques of DTV, and to get reaction from viewers. There are some interesting initial findings. They are summarized as follows:

Benefits of interactivity

- Control: Viewers feel that interactivity allows them to have more control over what and how much they wan to see and learn about a particular topic.
- Additional information: At the most basic level, people want interactivity to provide more detail information.
- Richer viewing experience: Interactive programs are perceived to be more engaging and providing more pleasurable experience.
- Better Education: Almost all viewers in the study see interactive television has a vision of formal and informal educational use of technology.

Negative impact

- Distraction: It is difficult for most people to concentrate on the separate information streams at one time. It is easy to lose focus.
- Weak underlying program: Viewers expressed the fear that producers will spend too much time on the interactivity material and reduce the quality of the program.
- Difficult interface: Viewers get frustrated when the interaction does not occur the way they would like them to, and that different programs have different types of interface.
- Make television too much work: Viewers have a fear that complicated interactivity will make the television too much like computers that they crash, require updating, and viewers need training to operate the television rather than simply click on the remote.

Unanswered questions

After the study, although participants see great potential for interactive digital television, they also left with many questions that need to be answered. According to the report (CPB, 1999), viewers want to know how and when this technology will happen, what will be available, what equipment they will need to get, and how much the hardware and the service is going to cost. They said that they need to get clear answers to these basic questions before they can make intelligent decisions about what hardware to buy, what service to choose, and when they should start the process.

Practical obstacles

As the results of the prototype study show that there are potential problematic and questionable areas in the technology of digital television. Carvin (1998) also summarized several issues that all future broadcaster and consumers of DTV should consider about this technology:

- Cost: At the beginning of any new type of technology, the cost to acquire it can be grant. DTV is no exception. This may put consumers to a halt when buying a piece of equipment that they know little about. Also, consumers may feel reluctant to give up the old analog television that they already have, and they then need to get a converter for the digital signals to decode the transmission to their household. Even the converter can be expensive, at least for some families that need it most to afford. The price for all DTV equipment may go down someday, but not in the most immediate future.
- Content availability: According to Carvin, not so many producers are actively producing materials for the digital market, but a lot of them are taking the analog TV programming and retool it for digital. Therefore, they are not producing the content specifically for the technology. Also, the program content may not even fit with the new

medium. If the consumers pay to get the old content that they used to see in analog TV, and to find that there is not much available content for the new technology, they may not even want to invest their money on it in the first place.

- Interactivity: Carvin mentioned that though digital TV signal transmission may be advanced, one thing is not changed: DTV is still a one-way stream, similar to the traditional analog TV because DTV spectrum can only be used by licensed broadcasters, not consumers. It means that in order to have interactivity, DTV needs to utilize other ends to have the consumer transmit information back to the broadcasters. So far, Internet seems to be the primary back channel for DTV communication.
- Commercialization: Just like the Internet, when a new technology starts to attract and become accessible to a significant public market, commercialization comes into view. Also, TV networks invest huge amount of money into the transition, and they want to see some pay back from the market. If making a profit is all people think about DTV, they will be unlikely to put educational programming as a priority. Even if Public Television takes up the responsibility to provide educational programming, with possible high cost and moderate return, how long can they last?

Carvin (1998) made no mistake in saying this, " There is a lot of potential in digital television but there are also a lot of excuses for us to not take advantage of it." It makes one think more about how this new technology should be utilize for the better of the society.

Summary

Digital TV is the most recent major advance in television broadcasting in nearly 48 years, with improved audiovisual features, and supposedly it will also improve students' satisfaction level in their learning experience. However, because DTV is relative new and yet to be accessible to majority of the society, little research has been done to see its effects in education. The prototype study conducted by Corporation for Public Broadcasting did yield some exciting findings and implications for DTV program developers as to viewers' feeling of being in control, having richer viewing experience, encountering weaker content, and trouble dealing with complex interface functionality.

David Carvin (1998) also proposed several issues for the public to ponder on about the future of DTV. There is first the cost of hardware or service subscription that may scare people away, then the content availability and quality for DTV programs, DTV interactivity back channels, and the possibility of major commercialization problem for DTV.

In May of 1997, Federal Commission of Communication mandated that the United States begin to replace standard analog television with digital television. By 2002, all commercial network stations need to be finished with their digital process, and by 2003, public broadcasters need to get the job done. Viewers will have the options to continue receiving analog broadcasting, or to purchase a digital television or a converter between 2003 and 2006. By then, stations have to return their analog licenses to the federal government. Between now and then, it is advisable for everyone to think about the future of television.

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Utilizing Edutainment to Actively Engage K-12 Learners and Promote Students' Learning: An Emergent Phenomenon

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Abstract

Researchers have claimed that while educational computer software does not necessary improve students' academic performance, it does provide for students a more interesting and motivational environment for learning. It naturally fits in the context of students' learning since it can deliver nonstop actions, realistic sounds and vivid colors to get students' attentions. It also corresponds to the ongoing move towards more student-centered learning (Ellington, 2000). The design of educational computer software adapts games and simulations to help students learn while having fun. Although nowadays at least one computer per classroom is used for instruction and the number of students per computer is decreasing, teachers are facing challenges to utilize educational software to engage students' learning due to the lack of sufficient technology infrastructures, the lack of proper and quality educational software, and the lack of training and support to make utilizations.

This paper will explore if educational software that entertains K-12 students can also promote learning in the practical educational context. Also, this paper is to investigate the emergent phenomenon of whether educational software works as edutainment to facilitate and motivate students' learning, and whether the utilization is implemented in real classroom instruction without obstacles. The ultimate goal of this paper is to explore the emergent phenomenon of utilizing edutainment to actively engage students and promote students' learning.

Introduction

The increased use of computers in education comes along with progressive technology, both hardware and software. It is really easy to discover educational software targeting at K-12 students. The design of educational computer software can be seen as the adaptation of the attributes of games and simulations to help students learn. The manipulation for educational purposes and entertainment is remarked as one kind of edutainment. However, we do not know specifically how students are likely to interact with varieties of educational software in terms of edutainment. Is it for educational purp oses or rather for leisure? Furthermore, utilization of educational software in classrooms is not clinical. The exploration of teachers' implementations of educational software for real instruction is rare reported and investigated. It is uncertain how teachers utilize educational software for their teaching. The focus of this paper is a preliminary analysis of at what degree the utilization of edutainment, in terms of educational software, in schools is taken place. We are particularly interested in discovering discrepancies beyond the emergent phenomenon.

Current Status of Technology in K-12

In 1996, President Clinton articulated a clear vision for improving 21st century education through the use of technology in American schools. Defining "Four Pillars" (U.S. Department of Education, 1996) as part of his Technology Literacy Challenge, the President called for broadening educational technology objectives to include not only hardware and connectivity, but also digital content and professional development. The "Pillar" of digital content asserts that effective software and online learning resources can increase students' learning opportunities.

Computers in K-12 public schools

In fact, with student populations growing (NCES, 1997) and many buildings and facilities aging (U.S. General Accounting Office, 1995), every school has its own unique priorities that compete for limited resources. All schools must ensure that the drive to integrate technology does not supplant the fundamental need to provide all students with basic skills such as reading and math although technology can be an effective tool for meeting learning objectives (CEO Forum, 1997). In 1995, reports suggest that nearly 60% of school computer purchases were used to replace old and outdated computers, resulting in only a marginal increase in the number of machines available to students (QED, 1996). In the 1998-1999 school year, the average student to computer ratio was 5:1 and the average student to multimedia capable computer ratio was 10.1:1 (QED, 2000). In the 1999-2000 school year, the average student to computer ratio was 5.4:1 and the average student to multimedia capable computer ratio was 9.6:1 (QED, 2001). The survey results for school year 1998-1999 and school year 1999-2000 were very close showing that no significant increase of computer available to students. The differences were embedded only on the percentages of Internet connection for these two school years. In year 1999, 95 percent of public schools and 64 percent of public classrooms are connected to Internet and have Internet access, and in year 2000, 98 percent of public schools and 77 percent of public classrooms are connected to the Internet and have Internet access (CEO Forum, 2001). Teachers' uses of technology at schools were reported as well but mostly stated as using computers daily for planning and teaching, as using the Internet for instruction, and as using e-mails. Among above usages, creating for instructional materials using computers accounted for the major utilization (CEO Forum, 2001).

Supports and training for teachers

Scrogan (1989) reported that many teachers wanted to learn more about technology but were unable to find satisfactory instruction. To overcome this, teachers were asking school systems to provide more relevant and consistent training and support for integrating technology into curricular (Becker, 1992). A more recent survey conducted by the National Center for Educational Statistics (NCES, 1999) indicated that less than 20% of current teachers reported feeling very well prepared to integrate educational technology into classroom instruction (Schrum, 1999). In general, K-12 teachers do not receive enough time, access, support, or encouragement to become comfortable with computers (Siegel, 1995). Recent research indicated that although teachers are eager to use technology for professional and curricular activities, a lack of teacher-development programs and time dedicated to experimentation hinder teachers' skills and knowledge (Schrum, 1995; Schrum & Fitzgerald, 1996). Teachers have indicated that their greatest barrier for use of technology is a lack of understanding of how to use it in classrooms (Hancock & Betts, 1994; Becker, 1992). Becker (1992) reported that teachers who had more experience with computers were more inclined to integrate the curriculum across subject areas and use computers as a tool for learning. Koontz (1992) found that teachers with some experience with computers had more favorable attitudes towards technology and were more willing to use technology in their classrooms. Clearly, access to technology and lack of ongoing support are major obstacles for educators interested in implementing information technologies in teaching (Schrum, 1995). Teachers are on their own to make up their decisions whether to use computers to teach and how to utilize computers into lesson activities. Use of computers in instruction tends to be by individual teachers.

Adoption of technological innovation

Rogers (1995) offered a significant review of adoption of technological innovation and found that the adoption depends on the potential adopter's determination of five criteria. These include (a) the relative advantage; (b) the compatibility with personal values, experiences, and needs; (c) the complexity of use; (d) the availability for experimentation; and (e) the observability of results to others. These factors all require attention prior to the initiation of the innovation. Moreover, the CEO Forum has developed the School Technology and Readiness Chart (STaR Chart) to provide a clear framework for assessing how prepared American schools are to meet the education challenges of the 21st century. The STaR Chart describes technology presence, use and integration in a typical school in four school profiles ranging from the "Low Technology" school that uses technology primarily for administrative functions, to the "Target Technology" school that integrates technology throughout the curriculum (CEO Forum, 1997). Beginning from 1997 and for each of the following three years, the CEO Forum would use the STaR Chart as the Backdrop for an assessment of how ready our nation's schools are to effectively use technology to enhance teaching and learning. The STaR Chart is available on-line and is handy to help schools and teachers accessing their readiness and development of technology for the current and future status.

Digital content

Digital learning is an educational approach that integrates technology, connectivity, content and human resources. When implemented correctly, it builds on the unique, dynamic characteristics of digital content to create productive and engaging learning environments (CEO Forum, 2000). Digital content can be randomly accessed, explored on many levels, interactive and engaging, manipulatable and creative. There is more about digital content in the 1997 STaR Report (CEO Forum, 1997):

> The digitization of information has led to more dynamic and interactive education content. Digitization has also transformed the way educators, parents and students use educational content. Not only can information now be packaged by traditional content creators in new and exciting ways - software, CD-ROMs or online resources - but it can also be used and creatively re-packaged by teachers, students and software publishers. In addition, new tools are available in the digital age allowing individuals to find, organize and create information as never before possible. (p. 28)

Assessing the degree to which digital information has been incorporated into classrooms can only be accomplished by examining the availability and use of digital content and digital learning tools (CEO Forum, 1997). The report of CEO Forum (2000) also indicates that people have placed much focus on hardware and connectivity than on digital content and digital learning. It is time for people to refocus on utilization and development of digital content and learning. It is evidenced to tell people's foci from numbers. Average school district spent 11 dollars out of 121 dollars per student on instructional software in the 1998-1999 school year (QED, 2000). Moreover, statistic data often omitted identifying kinds of instructional software in practice.

Instructional computer games as edutainment to students' learning

Educational computer software, as a form of highly interactive technology and a form of digital content, naturally fits in the context of students' learning since it can deliver nonstop actions, realistic sounds and vivid colors to get students' attentions. Educational computer software usually incorporates the nature of games and simulations into its design and development. In other words, while interacting with instructional computer games, students are engaged with education as well as having entertainment. The integration of educational purposes and entertainment turns the educational computer software into the edutainment.

Theoretical framework of games and simulations to students' learning

Dempsey, Rasmussen, & Lucassen (1994) put instructional games into simulations, puzzles, adventures, experimental games, motivational games, modeling and others. Instructional games sever many functions such as tutoring, amusing, helping to explore new skills, promoting self-esteem, practicing existing skills, drilling existing skills, or seeking to change an attitude. Research has shown that games and simulations can make a significant contribution to teaching and learning. The impact of games for education have been studied since 1960's although research did not specify computers as the medium of games. Past research has suggested that games improve student motivation, affective and cognitive learning. Randel, Morris, Wetzel, and Whitehill (1992) examined 68 studies regarding the effectiveness of games and simulations in terms of student performance compared with traditional classroom instruction. Of these 68 studies, 38 delineated no difference between traditional instruction and games and simulations in terms of student performance. However, 22 of the 68 studies demonstrated that the use of games and simulations enhanced student performance, and 12 studies indicated that students reported more interest in games and simulations than in traditional classroom instruction. Ricci, Salas, & Cannon-Bowers (1996) further explained that although games consistently have been found to provide a more interesting approach to learning than the traditional classroom environment, games did not necessarily provide a more effective training approach. In Klein and Freitags' study (1991), they indicated that several researchers proposed instructional games can motivate learners in a practice setting. They thought that games could provide extrinsic motivation for iterative practice and that games could be incorporated into instruction to enhance student attention. Games were motivational because they generated enthusiasm, excitement, and enjoyment and because they required students to be actively involved in learning. Stewart (1997) even made a statement that games could be effective instructional tools that entertain while motivating. Dempsey, Rasmussen, & Lucassen (1994) further suggested that technology-based instructional gaming has a wide spectrum of utility for learning. Ricci, Salas, & Cannon-Bowers (1996) defined computer-based gaming as a "rule-governed, goal-focused, microcomputer driven activity incorporating principles of gaming and computer assisted instruction."

Educational computer games and students' motivation to learn

The purpose of educational computer games is of course to teach, but many teachers found computer games a powerful motivator for initiating the learning process (Stewart, 1997). Students can be focused on the instructional content using an alternative learning mechanism, playing games, to the instructor. More research indicates that using gaming techniques in multimedia design allows students to become actively involved while making the session enjoyable (Metcalf, Barlow, Hudson, Jones, Lyones, Munfus, & Piersall, 1998). Children's interest in computer games and technology may be harnessed to good educational use (Fisher, 1994). The goal is to maintain the student's interest while increasing her/his skills and knowledge. Since learning occurs with repetition, a trainer wants a student to be motivated to come back to the game often. Educational software disguised as games will capture and hold a student's interest. Software that entertains will more effectively communicate its educational message. Compared to learning by rote, learning with colorful, dynamic computer screens will prevail every time (Millman, 1992). Educators should try to create learning environments in which students are allowed to make choices, initiate activities, and view learning as a celebration (Murphy & Thuente, 1995). The impact and implication for the educational context is as Dorman (1997) stated that, the expectation by students, all learning must take a gaming approach and be fun. The idea is to entertain education by edutainment media. Teachers and educators can make ultimate use of novel computer games engage classroom learning with more enjoyable perspectives and with better student motivations. Moreover, Evans (1996) also stated that students' academic performances were not necessary improved because of using computer games. Rather, computer games serve a different purpose. Games are supposed to be fun, get students' attention, keep students on task, and motivate them to be active learners.

Edutainment and the learning environment

Educational software in terms of edutainment, not limited to drill and practice for individual students, supports individual learning activities. While interacting with the educational software, students are taking their own paces to learn and construct their own understandings of the instructional messages that the software introduces. It corresponds to the ongoing move towards more student-centered learning, a move that has been steadily accelerating since the late 1960s (Ellington, 2000). Moreover, adopting computer edutainment to engage students to think and to learn is also an approach of constructivist learning. According to constructivism, the process of how students create meaning and knowledge of the reality is the major concern of the constructivist learning approaches. Instead of focusing solely on individually cumulating the acquisition of facts related to specific subject areas, students have more chances to work in groups and do tasks collaboratively. Students are engaged in making and evaluating their queries to solving complex, authentic problems together. They construct their knowledge based on their interpretations of instances in accordance with the social standards and regulations.

The emergent phenomenon

By reviewing statistics numbers and literature research articles, we found although more computers are available to students, the access and training are not consistent. There have been many attempts to understand patterns of technological adoption in education (Dalton, 1989; Dwyer, Rignstaff, & Sandholtz, 1991). However, the answer remains uncertain on how technology is used, how much it is used, and whether what exists is broken, worn out, or still in unopened boxes (Mehinger, 1996). In addition, adoption and selection of computer games are not required and uniformed to every school. There are no set standards and requirements for teachers to use computer games within or between schools. The choices of the kinds of computer games and simulations schools choose vary greatly. Although people are aware of the increasing popularity of computer games and their abilities to facilitate teaching and motivate learning, there are still obstacles of utilizing educational computer games in schools in terms of hardware infrastructures, software design and availability, and teacher training.

Hardware

Despite the number of students per computer has decreased to five students per computer in 2000 (QED, 2001), most regular classrooms only have one computer available for instruction and mostly for the instructor to use. In other words, it is impossible for the whole class to work with an educational computer game in a regular classroom where hardware is insufficient to provide the opportunity. Therefore, the engagement of computer games for instruction must be taken place in computer labs, whereas time logs of computer labs are full and in use most of the time. Consequently, the availability of hardware is not ready for teachers to apply educational computer games into their regular teaching strategies. The availability of hardware at this point of time can only allow educational computer games as the supplemental instructional materials or extra instructional activities to students. To individual teachers who likely are eager to utilize computer games to facilitate and motivate students' learning, it is not practical to happen in the context of K-12 schools so far. Another problem is that there is a huge amount of outdated computers that are still serving in K-12 schools but cannot run educational computer game software. Glennan & Melmed (1996) indicated in the RAND report that despite there is a rapid growth of innovation and purchasing of computers, the average school still makes limited use of computers and substantial numbers of schools have very limited access to technology of any kind. The platforms in schools are seriously outdated and waiting for replaced.

Software

When choosing educational software to use, teachers usually find it is difficult to have good quality software with desired content specified. Moreover, there are always not enough funds to purchase software. Glennan & Melmed (1996) pointed out that the education software market has had a rapid expansion in home education software; however, the market for school-based content software is modest and comparatively stagnant. Quality content software for K-12 schools is not broadly available since home edutainment materials do not always or readily translate to the classroom. They further explained that the economics of the school market do not work for software developers. It is very critical to gain profits on developing quality content software targeted at school markets. Schools spend very little on software. According to MDR's annual survey of 2001, schools spend 20% of their technology budget on software and spending toward hardware accounts for 67% of total technology spending. The shortage in content software persists. The development of content software for use in schools is a difficult challenge.

Teacher training

When technology is deeply introduced to a school, teachers are required to take new roles and learn new skills. However, research indicated that neither the initial preparation of teachers nor the current strategies for continued professional development have been effective in developing these new requirements (Glennan & Melmed, 1996). Use of technology to significantly affect classroom practice tends to be limited to small groups of teachers who are excited by the potential that they feel technology has to motivate their students or to access new resources (Glennan & Melmed, 1996). Most teachers have little formal instruction on how to use technology or how to select proper types of software to help them teach. The lacks of continual teacher training on technology and supports on utilizing technology have made some teachers with novice technology competence step back to what they are more familiar with, the traditional instruction method. According to MDR's annual survey of 2001, average schools devote 14% on professional development. There must be many schools allocate less than 14% of the whole technology budget on professional development. A survey revealed that teachers are less likely to have had training in more advanced technologies, such as multimedia computers and the Internet (Jerald, 1998).

Conclusion

Despite more and more educational software are getting available with good qualities in the market and despite the positive stimuli that educational software brings to students' learning, the fundamental focus should be whether or not the schools, teachers are ready to utilize it to facilitate teaching and learning in terms of hardware infrastructure, software adaptation, and teacher preparation. As Glennan & Melmed (1996) stressed there are two particularly important incidences, equipping teachers to effectively exploit technology for the benefit of their students and assuring a plentiful supply of high-quality content software. The readiness of all aspects is the key to the successful utilization.

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Cognitive Presence in Web-Based Learning: A Content Analysis of Students' Online Discussions

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Abstract

This first phase of a content analysis of online, asynchronous, educational discussions is designed to generate a method for automatically categorizing messages into cognitive categories using neural network software. This phase of research answers two questions regarding the method of automatically analyzing discussion messages: Can a neural network reliably categorize messages under optimum circumstances, and how can the method be improved to generate greater reliability? To determine whether neural network software can reliably categorize messages, two trials were conducted. The first, "best fit" trial, a proof of concept trial comprised only of messages which best fit the categorization model, generated strong reliability figures (CR = 0.84; k = 0.76), and the second, systematic sample, a sample much more indicative of the messages generated in an online educational discussion, produced formative reliability figures (CR = 0.68; k = 0.31) from which the method of analysis may be optimized. This analysis also provides a distribution based on cognitive presence categories and subcategories of one semester of graduate online educational messages.

Many universities and K-12 educational settings have adopted online, web-based instruction as a tool for delivering instruction. According to Green (2000, para 7), "Today, 75 percent of two- and four-year colleges offer some form of online education. By next year, that number will reach 90 percent." Hamm (2000, para 8) makes a slightly more conservative claim by quoting a study performed by the Chronicle of Higher Education: "60% of American colleges and universities offer online-learning programs, and 8% more plan on doing so in the next year." He also notes that the e-learning market is expected to grow from $1.2 billion in 2000 to $7 billion in 2003. Certainly, online delivery of instruction is growing as are fora whereby students engage each other. WebCT, one of the more popular suite of tools to support web-based collaborative learning boasts 1600 new installations in the past 18 months and nearly 11 million student accounts (Goldberg, para 3). Although there is no clear data on the number of students participating in online courses in which every transaction is electronic, there appears to be a migration away from courses delivered solely face-to-face to those either supplemented with or completely reliant on online discussion. This migration toward electronic classrooms means that the discourse from these learning environments is very easily captured providing an opportunity for researchers to study the process of learning in a way that has never been available before. Never before have we had access to electronic texts containing virtually every exchange made by every student for an entire term. Concurrently, our ability to use computers to process text and reveal underlying themes has steadily grown (Rife, Lacy, & Fico, 1998). The convergence of these two realities brings us to our current state in which we have numerous texts available, a growing set of analysis tools, but very little research to explain the phenomena that take place in the course of learning. Kuehn (1994, p. 172) also highlights this dilemma, "few researchers have adopted current communication theory to investigate computer impact or effects in instructional settings…."

Despite the availability of electronic discussion list texts, few analyses of the content generated by students have been conducted. A content analysis type of inquiry allows us to describe how students engage and generate material within an online setting thereby providing potential answers to questions such as: Does a chatroom conversation produce different cognitive results than either a teacher-led asynchronous discussion or a student-led asynchronous discussion? Henri (1992) makes apparent the role content analysis has to play in an instructor's ability to guide learning:

> Content analysis, when conducted with an aim to understanding the learning process, provides information on the participants as learners, and on their ways of dealing with a given topic. Thus informed, the educator is in a position to fulfill his main role, which is to offer immediate support to the individual and the collective learning process. (p. 118)

Over all, this study outlines the initial phase of the construction and use of a neural network to perform a content analysis of a large body of student messages for cognitive presence, one portion of Garrison, Anderson, and Archer's (2000) model to understand online learning environments. This type of tool may ultimately be used to gauge, guide, direct, and manipulate the learning environment. Despite Howell-Richardson & Mellar's (1996) research indicating that modifications to the structure of an online course produce significantly different communication outcomes, instructors currently have little ability to gain a bird's-eye view of the overall learning taking place, much less an ability to respond to that learning, assess it, or intervene. This research seeks to answer two questions. First, can neural networks be used to analyze and describe the cognitive landscape of online educational discussions? Second, at this phase, how is cognitive presence displayed in an online course?

Theoretical Background

Cognitive Presence

Garrison, Anderson, and Archer (2000, 2001) have developed a community of inquiry model, based on Dewey's (1933) practical inquiry model, which splits community-based learning into three overlapping areas: social presence, cognitive presence, and teacher presence. They operationalize cognitive presence by splitting it into four phases: triggering event, exploration, integration, and resolution, and use the following descriptors respectively for each phase: evocative, inquisitive, tentative, and committed. Specifically, cognitive presence is defined as "the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (p. 11). Garrison et al. employ their cognitive presence model to analyze an online discussion group. Their unit of analysis is the entire message mainly because messages are easiest to identify and occur naturally in discussion environments. Because a message may contain indicators for multiple phases, they have developed two heuristics for deciding which messages fall into which categories: code down and code up. They used human coders to classify messages, and this yields a reliability figure (k=0.74) which Riffe, Lacy, and Fico (1998) accept only for research that is breaking new ground, a category under which this research clearly fits. Also, they found that the greatest coding discrepancies occurred between coding for exploration and integration. They admit low occurrences of resolution and believe higher instances of resolution will be found "where applied knowledge is valued—particularly adult, continuing, and higher education" (p. 16)

Can Neural Networks Analyze Messages?

The use of neural networks in educational settings is rare and there are no accounts outlining the use of a neural network to analyze text messages of an online discussion group. Garson (1998) provides a number of reasons why social scientists have not adopted the use of neural networks in their research. First, neural network software has been available to the social scientist only since the early 1990's. Second, it is not clear how neural networks arrive at their conclusion; unlike an expert system, neural networks provide no audit trail outlining their reasoning. Also, neural network techniques are complex and leave researchers unsure whether their analysis is truly optimal; slight modifications to a number of parameters may yield a more optimal analysis. Nonetheless, neural networks are good at making predictions (e.g. stock market forecasting) and at classification. Garson cites 34 research studies using neural networks in economics and business, 9 in sociology, 7 in political science, and 45 in psychology (Garson, 1998, pp. 8-22).

Given a high enough reliability value, neural networks have the ability to classify large quantities of data which, for the present study, means that researchers do not have to sample a subset of all online messages from a course. Instead, the neural network classifies each message thereby eliminating sampling error. In comparison with statistical methods of analysis, Garson (1998) mentions:

> [N]eural models may outperform traditional statistical procedures where problems lack discernible structure, data are incomplete, and many competing inputs and constraints related in complex, nonlinear ways prevent formulation of structural equations, provided the researcher can accept the approximate solutions generated by neural models (p.1)

Clearly, student messages are filled with competing inputs related in a complex, nonlinear fashion. Further, traditional textual analysis of this type would require the use of multiple human coders classifying each message against a set of classification criteria, a resource-intensive technique which also generates approximate solutions.

Method

The method involves four steps starting with a text-based transcript of an online discussion and ending with the calculation of reliability statistics.

Database Creation

First, one semester's worth of asynchronous, online discussion messages were converted from a single text file containing all messages for one semester into a database such that each record represented one message and contained the message body, author, date, etc. This task was accomplished using SQL Server and a series of SQL statements to populate the database. These generic tools were used to streamline the process of making them publicly available over the World Wide Web.

Word Count Tool

Second, a tool was constructed to page through each message body and perform word counts in both self-defined and General Inquirer categories (see Danielson & Lasorsa, 1997; http://www.wjh.harvard.edu/~inquirer). The categorical word count procedure results in a database table with categories as columns, individual messages as records, and cell values representing the count of terms from each cognitive presence category. Self-defined categories allow researchers to define specific indicators for each category. For example, items falling into the cognitive presence phase "integration" often refer to previous messages or draw from a course participant's prior knowledge; therefore, typical "integration" messages incorporate terms and phrases such as "thanks," "that reminds me of," "compared to," and "I agree." The researcher may create one or a number of categories that serve as indicators that a message should be categorized as an integration message. This tool not only allows for the creation of new, user-defined input categories but also incorporates existing input categories from the dictionary of terms found in the General Inquirer. This dictionary is comprised of 11,788 words in 182 categories. Each message was analyzed against each self-defined and General Inquirer category of terms and a simple word count was taken to determine the weight of each category of terms in each message. For example, the General Inquirer category "positiv" contains the words "up, abide, and yes" meaning that the following sentence will receive a "positiv" score of two: "Yes, I had to look up to see the icon." Further, the "positiv" score of 2 is normalized so the neural network can accurately compare scores across messages. Normalization is performed by dividing the number of times the terms in a single category appear in a message by the total number of words in the message (2/10 = 0.2).

Neural Network Training

Third, a feedforward, backpropagation, neural network was trained to classify each message as falling into one of five categories (triggering event, exploration, integration, resolution, or noncognitive). This was done by human-classifying a group of messages to be used as the training set, training the neural network on that set of messages, and then classifying a second set of messages for reliability purposes.

Reliability Measures

Fourth, reliability measures were taken comparing human-coded messages with those classified by the neural network. Huck (2000) recommends the use of multiple reliability measures for a single study (p. 98). For this reason and because this study replicates a similar study by Garrison, Archer, and Anderson (2001), two reliability measures were employed: Holsti's (1969) coefficient of reliability (CR) which measures the agreement between two coders divided by the total number of messages analyzed and Cohen's kappa which corrects for chance agreement among coders. The difference between the Garrison et al. study and this one is that Garrison et al. performed a human – human comparison whereas this study performed a neural network – human comparison.

Results

To determine whether the neural network analysis produces results comparable to human-coded content analysis, benchmarks from a human-coded content analysis by Garrison, Anderson, and Archer (2001) were compared to results from this neural network analysis. Garrison et al. went through three phases of training human coders to reliably categorize messages and used both Holsti's (1969) coefficient of reliability (CR) and Cohen's (1969) kappa (k) to measure inter-rater reliability. Garrison et al. generated the following reliability figures:

Reliability Measure	**Trial 1**	**Trial 2**	**Trial 3**
CR	0.45	0.65	0.84
Kappa	0.35	0.49	0.74

Table 1. Reliability measures for Garrison, Anderson, & Archer's (2001) content analysis of an online discussion.

Best Fit Sample

The analysis using the neural network to classify messages is a multi-phase process of which this paper presents the first phase. This phase seeks to answer whether it is possible at all for a neural network to classify messages. In this phase, the messages best representing each category were coded and used to train and test the neural network model. This "best fit" trial yielded the following reliability figures: CR = 0.84 and k = 0.76. This test set (n=26) of optimal messages generates the following matrix after being run through the trained "best fit" model.

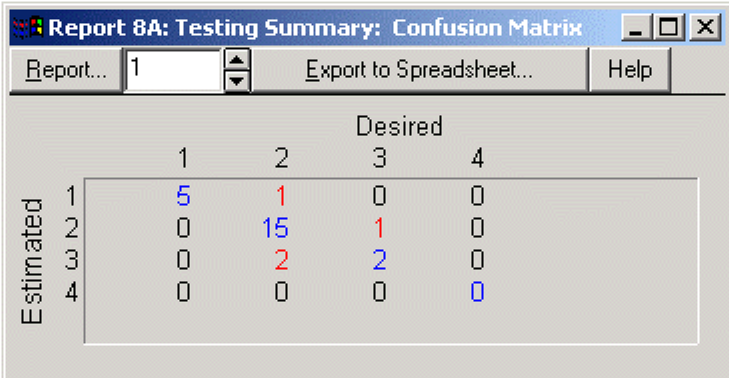

Chart 1. The desired results are compared to the neural network's estimated results, and the numbers appearing diagonally indicate that the neural network matched the coded test set of messages.

In this set, 1 indicates a triggering event, 2 is an exploratory message, 3 is an integration message, and 4 is a resolution message. This trial indicates that a neural network can reliably discern the first three categories.

Systematic Sample

The purpose of the "best fit" trial is to determine whether a neural network can be used to categorize text messages at all; the second trial uses a systematic sample of messages in which both the training set (n=100) and the test set (n=100) are a systematic sample of every 20 messages. There are 1,997 messages in all; therefore, this sample represents a cross-section of messages occurring throughout the term. Further, this sampling technique introduces noise into the analysis; to accommodate for this, a fifth (noncognitive) category was used. This category represents non-cognitive messages (e.g. greetings and short agreement messages), course management messages (e.g. "When will the textbook be available," or "when is the next chat?"), and technical support messages (e.g. " I can't get into the chat room," and "Why are my messages not showing up on the discussion list?"). A neural network trained against 100 messages using all five categories yielded a CR value of 0.68 and a kappa value of 0.31 generating the following message category results:

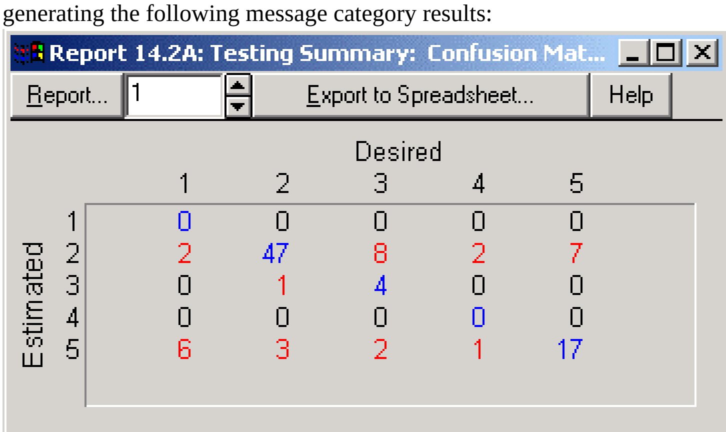

Chart 2. The introduction of a fifth (miscellaneous) category adds real-world noise to the neural network analysis.

Finally, the systematic sampling of 20% of the messages from the term provides insight into the cognitive effort displayed by the course participants. The first chart displays the percentage of messages by broad cognitive category type, and the second displays messages by the subcategories which make up each category type.

Cognitive Presence by Category	**Percentage**
Not Cognitive	48%
Triggering Event	3%
Exploration	39%
Integration	9%
Resolution	1%

Table 2. Messages by cognitive presence category.

Cognitive Presence By Subcategory	Percentage
Not Cognitive	
Unrelated	20%
Course Management	12%
Technical Support	12%
External Reference	4%
Total Not Cognitive	48%
Triggering Event	
Recognizes Problem	1.5%
Puzzlement	1.5%
Total Triggering Event	3%
Exploration	
Personal Narrative	6%
Information Exchange	12%
Brainstorming	5%
Divergence Among	4%
Leap to Conclusion	5%
Suggestion	6%
Divergence Within	1%
Total Exploration	39%
Integration	
Creating Solutions	0.5%
Synthesis	1.5%
Convergence Within	2%
Convergence Among	5%
Total Integration	9%
Resolution	1%

Table 3. Messages by cognitive presence subcategory.

Discussion

Findings

The first trial indicates that in the absence of noise, a neural network can be used to categorize messages into the cognitive categories outlined by Garrison, Anderson, and Archer (2001) based on linguistic cues. In the trial which introduced the noise which naturally occurs in discussion lists, we see that the model overgeneralizes on categories two (exploration) and five (miscellaneous), that it undergeneralizes on integration messages, and that it does not discern triggering events and resolution messages from the others. These findings provide critical, formative information which can be used to optimize and therefore improve the model. Methods for improving the model's ability to correctly categorize are outlined below.

Optimization

Just as Garrison et al.'s coders optimized their coding algorithm between times they coded, the neural network method of analysis may also be optimized. The above reliability reflects an initial brute-force analysis of each message and takes as input weights generated by analyzing each message against a category of terms in the General Inquirer dictionary. The following steps may be taken to improve the model:

<u>Word sense disambiguation:</u> This simply means that individual words are classified according to their parts of speech. For example, the word "test" may be used as either a verb or a noun, and a word sense disambiguation routine will clearly separate those instances of "test" that are nouns and those that are verbs. This should dramatically reduce the amount of noise in the database.

<u>Increased training set:</u> The next phase of this research is the analysis of six eCore courses, online post-secondary, core curriculum courses offered by the University System of Georgia. In this phase of research, six instructors will analyze 200 messages each thereby generating a training set of 1100 messages. In comparison, the current research used 100 messages as its training set and 100 messages as a test set. Building a model from 1100 coded messages should improve the generalizability of each category and therefore the model's ability to correctly classify messages.

<u>Message hierarchy metainformation:</u> In the current model, the only hierarchy information fed into the neural network is whether each message is a reply to another message or not. Garrison et al.'s model indicates that messages are partially classified not only based on their textual content but on their place within a given thread hierarchy. If a message is the first in it's thread

hierarchy, it is most likely a triggering event. If it is near the beginning of a thread and is a response to another message, it is most likely either an exploratory or integrative message.
Improved categories: Create subsets of each category that are very specific, and ensure that each message fits cleanly into a category.

Cognitive Presence Distribution

The distribution of messages into cognitive presence categories is similar to that found by Garrison, Anderson, and Archer (2001) in that a majority of messages fell into the exploration category with fewer integration messages, only a few triggering events, and practically no resolution messages. The discussion topics and goals of the course define the distribution we found. The goal of the course is to give each student experiential knowledge of web-based learning. It is up to the instructor to define whether resolution can practically be achieved in the course; resolution is usually reserved for more practical tasks in which students state that they have resolved an issue which means they have applied knowledge in a real-world setting and have found that the real-world outcome affirms knowledge gained from the course. Although students were creating their own web-based learning modules, these modules were not intended to be the product of a learned body of knowledge; rather these modules were intended to be tasks from which questions emerge. Given this course structure, it makes sense that resolution is rare and exploration dominates. Interestingly, the number of triggering events is fairly low which may also be attributed to the course structure; students were not given a formal triggering event or question by the instructor each week; instead, the instructors allowed the students' exploration to define the direction of the course. In this case, triggering events were more likely to be found embedded within exploratory messages. Tracing triggering events may be assisted by the creation an overall diagram of the course structure allowing us to see not triggering events as defined by the linguistic cues within the message but rather as defined by the messages emanating from these triggering events. That is, if we find that one message spawns a critical debate, then we may in retrospect define that message as a triggering event. This information can be displayed graphically for use by those coding the training set of messages and numerically for use by the neural network.

The Next Phases of this Research

It is expected that a well-trained neural network will perform just as reliably as a set of human coders at classifying messages into cognitive presence categories. This method of analysis will then provide a broad overview of the cognitive effort displayed by students throughout the semester and allows for instructors to make adjustments to their approach in order to bring about desired displays of cognitive effort. Further, this rapid analysis method provides a tool instructors may use to conduct their own research on finely grained aspects of the cognitive dynamics of a course. This method may allow us to answer questions such as: Which displays of instructor involvement generate exploration and which generate integration? Are socially engaged students also cognitively engaged? How many course participants is optimal for higher order thinking? Which class participants encourage the integration of ideas?

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The Application of Carl Rogers' Person-Centered Learning Theory to Web-Based Instruction

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Abstract

This paper provides a review of literature that relates research on Carl Rogers' person-centered learning theory to web-based learning. Based on the review of literature, a set of criteria is described that can be used to determine how closely a web-based course matches the different components of Rogers' person-centered learning theory. Using the criteria based on Rogers' learning theory and the person-centered model of instruction developed by Miller and Mazur (2001) a case example of a web-centric course is evaluated.

Relevance of Rogers' Approach to Learning for Web-based Instruction

Education through the years has integrated new technologies to enhance the learning experiences of students. During the twentieth century we have seen the advent of technologies such as projection systems and television expanding educational capabilities beyond the face-to-face classroom setting to teaching at a distance. The 1990s ushered in the World Wide Web (WWW), a technology expanding the capabilities of teaching at a distance possibly as much as television and projection systems expanded education in the twentieth century. While the WWW has expanded the possibilities of education it is also moving educators to consider new ways of teaching and learning because the WWW has literally created a new type of learning environment with possibly as much potential for student learning as a traditional classroom.

Many educators and researchers have begun discussions about the potentials for learning as well as some of the outcomes experienced through web-based instruction. Some of the outcomes discussed are the aspects of active participation shown by students in web-based learning environments (Brown, 1997; Greening, 1998; Oliver & Omari, 1999), the construction of knowledge (Stefanov, Stoyanov, & Nikolov, 1998), problem solving (Corren-Agostinho, Hedberg, & Lefoe, 1998; Oliver & Omari, 1999), students leading the learning (Berge, 1997; Bonk & Cummings, 1998; Stefanov et al., 1998), and teachers acting as facilitators (Brown, 1997; Stefanov et al., 1998). The outcomes mentioned in many articles on web-based learning studies such as Chalmers' (Chalmers, 1997) and Lazlo and Castro's (Laszlo & Castro, 1995) articles can be identified as components of learning as described by Carl Rogers' person-centered learning theory.

Individual Learning in Web-based Environments

Because the WWW is based on hypertext, which is words and images linked by multiple paths (Landow, 1997; McKnight, Dillon, & Richardson, 1996), the learner selects the paths to explore and thus discovers new links of information. It is through the linking of these multiple paths of the hypertext environment in which students become active participants in the construction of knowledge and meaning (Brown, 1997). Another aspect of the Web affecting learning is the ability to enter or leave at any point within the Web. While there are often centralized information centers, a user can often find information from any access point based on their own investigation and experience (Landow, 1997). Student explorations of web-based information will not only help them become active learners but it will also generate attitudes for personal development. These explorations allow learners to pick and choose where they want to go and what they want to learn as well as determine the importance of the information found. The learning possibilities could increase the potential impact on areas such as self-esteem, self-control, self-efficacy and motivation (Laszlo & Castro, 1995).

Collaborative Learning in Web-based Environments

While the WWW can provide opportunities for individual active learning it can also provide opportunities for collaborative learning and the development of learning communities. Using the WWW and the various forms of communication available on it, students can learn through group-based assignments, research projects, and presentations. Collaborative learning on the web can enhance the learning experience for the students more so than individualistic learning on the web because it could create a more communal or team atmosphere. Chickering and Ehrmann (1997) found that working with others increases involvement in learning because good learning is collaborative and social not competitive and isolated. While increasing student involvement, the web also allows the students to assist each other in the exploration of answers to areas of common interest, share constructed knowledge and interpretations of knowledge, and build upon that knowledge through feedback from peers (Graham & Scarborough, 1999; Harasim, 1990).

While collaborative learning can occur just as easily in a face-to-face situation there are some advantages to web-based collaborative learning. Collaborative learning on-line can be done either in a same time/any place situation (synchronous communications) or in an any time/any place situation (asynchronous communications). Using asynchronous communications the learners are allowed to respond at a time most appropriate for them, which can allow for opportunities of reflection. The potential for anonymity of the contributors, can also be a great equalizer when learners will not need to struggle for their chance to speak, and everyone can make a contribution that will be "heard" by all class members (Brown, 1997). Anonymity can also allow learners to feel that they can be open to expressing their opinions in an open environment allowing better comprehension and affirmation, which are key behaviors at the core of collaborative communication (Zimmer & Alexander, 1996). To ensure development of a learning community the individuals will need to develop and maintain a group environment with all members assuming at least some of the responsibility for the environment starting initially with the facilitator (Armstrong & Yarbrough, 1996).

The Need for a Change in Web-based Learning Environments

While web-based learning environments seem attractive in their potential to widen the scope of users' experiences, these new technologies also have the potential to create artificial and possibly depersonalizing social circumstances through the lack of communication. In the past one of the largest complaints from students in distance education situations is a sense of alienation that leads to dissatisfaction of the learning experience (Biner, Dean, & Mellinger, 1994). In a web-based learning experience it is necessary for the instructor to establish and facilitate continual lines of communication so that students do not feel that they are all alone. Another change that is needed for web-based learning is the locus of control. As in the past, when new interactive technologies are introduced into learning contexts, the role of instruction and the instructor needs to be examined. In web-based learning environment the locus of control shifts from the instructor to the student due to the environment. This change will reflect less control on the part of the instructor as he/she facilitates the learning learners' opportunities for controlling more of their own exploration and interaction. Instruction enhanced and shaped by facilitation may be a key to web-based learning environments because students will need specialized guidance exploring their on-line learning contexts. These needs are all focused upon in the person-centered learning theory developed by Carl Rogers.

Carl Rogers' Person-centered Learning Theory

When Rogers wrote Freedom to Learn (1969; Rogers & Freiberg, 1994) he focused on traditional schools but saw the person-centered educational approach developing its strongest roots in alternative schools and universities without walls. While many instructional theories focus on the learners' achievement of specific learning objectives, Rogers' learning theory focused on a goal of helping the learner learn how to learn. Rogers felt the learner would become a freely functioning, self-enhancing, self-actualizing, creative, and dependable person with this focus.

Carl Rogers claimed he developed his person-centered theory because we live in a constantly changing world and as people in this changing world, we need to be willing to change our thinking to adapt to these changes. More importantly, students need to learn how to learn in order to adapt to the different types of learning required in a variety of settings and for a myriad of purposes. Rogers boldly suggested the facilitator should encourage the learners to charge off in new directions dictated by their own interests and to unleash their sense of inquiry and exploration (Rogers & Freiberg, 1994).

Rogers' model theorizes a person emerging from therapy or from the best of education has experienced optimal psychological growth meaning the learner is able to freely function in all of his or her potentials, self-enhancing, continuing to develop, and always seeking newness in each moment, resulting in a more self-actualized person (Rogers & Freiberg, 1994). Maslow (1970), describes this self-actualized person as someone who has developed or is developing into the full stature of which he or she is capable. The development of a self-actualized person through the person-centered theory is important in education because one goal of education is to develop learners into whole people. The learners will become people freely functioning in all aspects of love, feeling, and creativity. Of importance, is that these people may continue to learn through life rather than becoming automatons able to recite the information provided to them (Patterson, 1973).

Another aspect of the person-centered learning theory connected to self-actualization is that person-centered learning experiences help the learners become a more creative (Patterson, 1973). As a learner becomes more self-actualized he or she will be able to perceive reality more accurately, accept himself or herself and others, become more spontaneous, independent, and more creative (Davis, 1992; Maslow, 1970). As the learner understands himself or herself more he or she will be able to make meaning of the world as well as become more understanding of varying views and perspectives.

While the development of self-actualized people, who are life-long learners, is a commendable goal how can this goal be achieved? First, a teacher should realize that the only person who can reach the goal of becoming a self-actualized person is the individual learner. Second, unlike in some instructional methods of providing the knowledge to the learners, the teacher in a learner-centered environment becomes a facilitator of the learning the students themselves conduct. It becomes an experience of significant learning because the individual initiates it, allowing the individual to provide personal control and the element of learning is built into the whole experience (Sahakian, 1970).

It is important for the teacher to facilitate the learning and allow the students to be challenged to think for themselves rather than being given information (Rogers & Freiberg, 1994). There are several tasks a teacher should do when positioning themselves in a facilitator role instead of a traditional teacher role. The first is to set the mood for the environment. There should be a sense of cooperation and trust within the group. A competitive attitude among members of the learning group will disrupt the sense of trust and cooperation. Next, the teacher as facilitator should make themselves available as one of many resources of information rather than as the main source of information for the students. Most importantly though, the teacher as facilitator should be aware of the attitudes he or she holds. The teacher needs to feel acceptance of his or her own feelings thus becoming a real person in relationship with the students (Rogers, 1961). It is important for the teacher to show realness as a person or in other worlds showing his or her self-actualization because if the goal is to help the students learn how to learn and become more self-actualized, the teacher needs to be self-actualized to foster it in others (Patterson, 1973). The characteristics Patterson describes was also found when Rogers and Freiberg (1994) talked to students and found that students wanted many of the same tasks required of a facilitator. They discovered that students want to be trusted and respected, wanted freedom, a place where people care, chances to make decisions, teachers as helpers, and teachers who help them succeed (Rogers, 1961).

How Does Rogers' Person-centered Learning Theory Fit with Web-based Learning?

How does Rogers' person-centered learning theory apply to web-based learning as currently many web-based courses could fit well under the problem-based constructivist instructional model? Rogers' theory would work with web-based courses on several levels. The first is Rogers felt his theory of learning was most applicable in non-traditional classes (Rogers & Freiberg, 1994). Most people would agree web-based courses fit into being non-traditional classes. Many web-courses also meet the needs of a person-centered learning theory because the teacher assumes the position of a facilitator rather than the traditional role of knowledge giver. As the teacher takes on the role of facilitator the students take on the roles of knowledge seekers as they focus on what they want to learn within the class topics. The roles of teacher and students is the key focus of Rogers' person-centered instruction because Rogers believed that the student should be the center of instruction and should conduct the learning thus providing personal control into the experience of learning (Rogers & Freiberg, 1994; Sahakian, 1970).

The major focus of Rogers' learning theory is that the learning should be student directed and web-based courses provide a fertile ground for student directed learning. The nature of the World Wide Web puts learners in a situation where they will search for information. Through their searches they will experience success and failure, but it is the experience of directing their own individual learning that promotes a growth of self. This growth will allow students the opportunities to learn the process of learning firsthand and allow them to further develop themselves into their fullest potential as human beings.

Criteria for Evaluating Web-based Courses Consistent with Rogers' Approach to Learning

Using Rogers' person-centered learning theory I have developed nine criteria to determine if a web-based course fits with Rogers' approach to learning (See Table 1). These criteria are based on a person-centered instructional design model developed by Miller and Mazur (2001). Using these criteria, an evaluation of a course can be made to determine if it meets the needs stated by Rogers of a person-centered learning experience. The criteria can be used to not only determine if a class is consistent with a person-centered focus but also can help instructors and instructional designers enhance classes to fit closer to Rogers' approach to learning.

Table 1. Person-centered Instructional Approach Criteria for Web-based Courses

Criteria	Criteria Description
1	The course provides an emphasis on the learners' interests, personal ability, and prior knowledge of the instructional topic.
2	The facilitative instructor should connect students' knowledge and interests with content principles of the course.
3	The facilitative instructor should select an environment that supports collaborative learning and learner control.
4	The facilitative instructor allows students to develop individually achievable objectives based on their interests and abilities within the context of the course. This could be done in the form of a written contract with the facilitative instructor.
5	The facilitative instructor allows students to develop individually achievable objectives based on their interests and abilities within the context of the course. This could be done in the form of a written contract with the facilitative instructor.
6	Learners work with the facilitative instructor to organize the areas of interest to cover so he or she can meet the needs of the students' learning objectives and maximize the learning potential.
7	Learners work with the facilitative instructor to organize the areas of interest to cover so he or she can meet the needs of the students' learning objectives and maximize the learning potential.
8	The learners conduct self-evaluation based on their individual learning objectives outlined in their learning contracts. The self-evaluation should show the significance of the learning experience and could also provide focus on levels of personal involvement, self-initiated involvement, and learners' pervasiveness.
9	Outcomes of the course should show significant learning. This could include an accumulation of knowledge on the topic, satisfaction in the learning, desire to master the experience, and a greater understanding of any problems and potential resolutions within the content. The learner should also experience increased levels of self-actualization.

Case Study Example of the Application of the Person-centered Learning Criteria

Description of the Video for Distance Learning and Multimedia Course

The course I selected as an example of the application of applying Rogers' person-centered instructional approach to a web-based course was on video design for distance learning and multimedia that was taught during the Spring 2000 semester. The case example course was a graduate level course offered as an elective in an instructional design program from a southeastern university. The purpose of the course was to discuss a variety of video applications for multimedia development and distance education. The course was framed around concepts and principles of film theory and cinematic narrative research and used classroom exercises and projects focusing on basic video and video production skills to enhance multimedia and distance education course development.

The course is described as "web-centric" due to a majority of the course materials being available from the course web site however the course does include four "face-to-face" meetings during the semester. The web site provided web-based mini-lectures, relevant web-site links, and a threaded discussion feature for discussions of course readings and collaborative interaction. While the class did meet in a face-to-face setting four times during the semester, students could attend class at the specified site or they could attend via 2-way compressed video hook-up. This attendance option allowed students outside the central Kentucky region to take part in the class without coming to the class meeting site. Based on the web-centric format of this course, I felt this would be an appropriate candidate for evaluation based on a Rogerian approach to learning. The evaluation was conducted by reviewing the course syllabus, course documents, and a brief interview with the course instructor. Each of the nine criterion are presented in italics followed by a statement of meeting or failing to meet the criterion and a brief description of how the course meets or fails to meet the criteria.

Case Study Evaluation Results

Criterion 1: The course provides an emphasis on the learners' interests, personal ability, and prior knowledge of the instructional topic.

The course met criterion 1. The course needs to accommodate a wide range of skill-levels and abilities students bring to the course. The instructor developed three areas or constellations, as called in the course, based on conceptual, technical, and application skills to meet these needs. Each constellation listed topics students could select and focus their personalized instruction upon during the course. An example of this selected focus was the technical constellation, which required students to choose 5 out of 12 technical areas they wanted to master within the course.

Criterion 2: The facilitative instructor should connect students' knowledge and interests with content principles of the course.

The course met criterion 2. The application constellation of the course required students to select 2 out of 6 topic areas with one of the topics required of all students connecting the technical areas students focused on mastering within the course.

Criterion 3: The facilitative instructor should select an environment that supports collaborative learning and learner control.

The course met criterion 3. Because the class only met face-to-face four times during the semester the teacher used a threaded discussion list on the Nicenet web site (http://www.nicenet.org). This site allowed the instructor to create discussion topics, post questions, and moderate online discussions with the students. Using the Nicenet threaded discussion list, the students were able to post messages to other students and the teacher either publicly or privately.

Criterion 4: The facilitative instructor allows students to develop individually achievable objectives based on their interests and abilities within the context of the course. This could be done in the form of a written contract with the facilitative instructor.

The course met criterion 4. The course met this criterion by allowing students to set their objectives by selecting topic areas that would help them at their present skill level or help them to advance to a higher skill level using the technologies available to them.

Criterion 5: The facilitative instructor allows students to develop forms of self-evaluation to demonstrate significant learning based on the individual students' learning objectives.

The course did not meet criterion 5. While the course had been designed to allow students to develop individually achievable objectives there were no opportunities within the course that allowed students to develop personalized forms of self-evaluation to demonstrate significant learning. The instructor set the evaluation methods used within this course.

Criterion 6: Learners work with the facilitative instructor to organize the areas of interest to cover so she can meet the needs of the students' learning objectives and maximize the learning potential.

Based on the evaluation using only publicly available course information and a brief interview with the instructor the course cannot be evaluated on criteria 6. To answer this question it would be necessary to conduct observations of the interactions that occur in the learning environment.

Criterion 7: The facilitative instructor identifies, selects, and presents to the learners resources to enhance their learning experience.

The course met criterion 7. The instructor provided a links page off of the course homepage listing several web sites providing additional learning resources for the students. The instructor also provided a course video with instructional clips as well as several mini web lectures students could access to help with their understanding of the required course text.

Criterion 8: The learners conduct self-evaluation based on their individual learning objectives outlined in their learning contracts.

The course did not meet criterion 8. There was no information provided about learners conducting self-evaluations. Based on the available information the instructor evaluated students based on class participation, technical and application constellation exercises, and the final project.

Criterion 9: Outcomes of the course should show significant learning.

The course met criterion 9. The course had been offered for three semesters with the constellation first being introduced in the second semester offered. Students rated the course during the initial semester at 3.6 of a possible score of 5.0. The second semester using the constellation approach has reached a 4.2 out of a total of 5.0. The instructor also found a high quality of work in the video products presented by the students. The students of the second semester also suggested additional constellation activities that have been incorporated into the course. The suggested activities showed that students were interested in further accumulation of knowledge on the topics and wanted to suggest the learning opportunities to help future students.

Summary of the Course Evalua tion

Overall this course promotes a Rogerian approach based on the criteria developed for evaluation. Based on information available for the evaluation, the main area of concern for this course using a person-centered instructional mode was the lack of student-developed forms of self-evaluation and a major focus on teacher evaluation of student progress. To allow students to feel they are developing their own learning objectives it would be recommended to also allow students to develop individualized evaluations of their performance. Although the course does not meet all of the criteria, there has been an obvious change in the satisfaction of the course based on the increase of course ratings since the constellation approach was used. The increased course ratings met one of the components of significant learning, which can promote increased interests in the topics and increased levels of self-actualization within the students. Based on the results of this case evaluation, specifically the outcomes that were reported from the instructor it can be inferred that providing the course with a Rogerian person-centered focus increased the potential for positive outcomes.

Conclusions

Several conclusions have been made from the application of the Rogerian person-centered criteria to a web-based course. The nine criteria posited in this paper can be used to identify the extent that a web-based course fits with Rogers' person-centered learning theory. Using the person-centered learning criteria can be used to help adapt the instruction of the course to fit a full model of person-centered instruction such as Miller and Mazur's person-centered model of instruction (2001). It is necessary to conduct additional research into the impact of person-centered instruction such as Miller and Mazur's model (2001) on web-based courses. It will also be necessary to begin studying what types of instructional models work best in web-based instructional learning environments.

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ANALYZING TEACHER PREPARATION TO INTEGRATE TECHNOLOGY IN CLASSROOM INSTRUCTION

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Abstract

What is not fully understood about educational technology is how to transform computer technology into a powerful pedagogical tool. One way to address instructional issues associated with integrating computer technology in classrooms is to analyze educational best practices associated with technology integration in classrooms. Technology standards for teachers were established and a tool to examine the quality of computer technology integration was developed and validated for a school district undertaking a district-wide technology professional development initiative. Pattern analysis procedures demonstrated that the measure was appropriate for determining the extent of technology integration and for identifying appropriate technology training themes.

Several national organizations are currently involved in the establishment and proliferation of national technology standards for teachers including the International Society for Technology in Education (ISTE) and the National Council for Accreditation of Teacher Education (NCATE). Although many reasonable and appropriate technology standards for teachers exist, these goals are often stated in abstract or general terms. Additionally, since there is a great deal of variability in educational beliefs, technological availability, and state and community expectations, technology integration should be locally defined, using available research models and national standards as a foundation (Pierson, 2001).

We launched a technology professional development initiative in a school district by establishing a set of technology standards and indicators that clearly described educational best practices for teaching and learning with technology that teachers could implement in their classrooms. The technology standards on which the professional development model was established was formulated by synthesizing national, state, and local technology standards and then identifying educational best practices that supported these standards within the local context. We then reinforced a pedagogy that enhanced and improved teaching and learning using technology tools and resources through performance assessment and financial incentives. This study evaluated and validated a comprehensive, standards-based technology professional development model for teachers that can be customized for each local context.

Theoretical Framework

The integration of technology in classrooms and schools is a complex change process that entails supporting curriculum goals through the instructional use of computer technology to enhance student learning (Dockstader, 1999). Educational change models often attempt to assess and explain the change process in terms of dimensions or degrees of change. Consequently, one way to better understand the difficult instructional issues associated with the integration of computer technology in classrooms is to examine how teachers implement computer technology.

Several models or strategies have been employed by educational researchers and practitioners to provide a systematic approach for determining the quality of innovation implementation. The Concerns-Based Adoption Model (CBAM) (Hall, Wallace & Dossett, 1973) emphasizes change as a developmental process experienced by individuals implementing innovations within an organizational context. CBAM has evolved into a comprehensive systemic change model that allows change investigators and facilitators to understand organizational change from the point of view of the persons affected by the change (Surry, 1997).

CBAM is based on the assumption that change is best understood when it is expressed in functional terms—what persons actually do who are involved in the change. Since change involves developmental growth, the focus of facilitation is with individuals, innovations, and the context (Hord, Huling-Austin, & Hall., 1987). CBAM provides for the development of diagnostic tools based on the design of the innovation being evaluated and the operational patterns of those using the innovation.

One such tool that a CBAM investigator may develop and use is the Innovation Configuration Matrix or Map (ICM). The ICM delineates an innovation in the form of a two-dimensional matrix along a scale that renders closer approximations of conceptualized implementation or use along one dimension of the matrix and the various configuration components along the other dimension of the matrix. The ICM has relevance for instructional designers and educational practitioners. Rather than being a static measure, the ICM provides a procedural definition of the specific educational components and features of the innovation within the context in which it is being implemented.

Research questions about educational technology are better formulated when they are concerned with issues of instructional quality and productivity. This study developed and validated an ICM for a school district's technology professional development model based on technology standards and educational best practices associated with these standards. The ICM was used as a tool to analyze the integration of computer technology in classrooms in the school district.

Methods

Instrumentation

An instrument for analysis of technology integration and implementation in classrooms was developed. This instrument, the *Technology Standards Integration Configuration Matrix* (*TSICM*) was based on a consensus-building process that followed a procedure developed by Heck, Steigelbauer, Hall, and Loucks. (1981) and used previously by the researcher (Mills & Ragan, 2000). Relevant national, state, and local technology standards were reviewed and evaluated by the researcher in conjunction with the district technology committee and technology coordinator. The committee agreed upon 18 technology integration standards that were appropriate for the school district. Technology integration standards were organized into three skill sets or phases: Using and Operating Technology in the Classroom (Standards 1-6), Facilitating and Managing Classroom Technology (Standards 7-12), and Technology Integration (Standards 13-18). Each successive phase was intended to identify a set of instructional strategies that exemplified a more appropriate application of technology or a higher quality of technology integration into classroom instruction and learning.

Each technology standard was established as a component of the TSICM and then variations for each component were identified. Variations for each component consisted of discrete categorizations of technology implementation for the corresponding component. Component variations were designed to represent teacher classroom practices along a continuum from unacceptable use to ideal use. The component variations were refined by the technology committee to reflect the actual practices of teachers using computer technology in classrooms. The components and component variations were organized into matrix comprised of four variations for each of the 18 components with each successive variation indicating a level of use representing a closer approximation of ideal or appropriate educational use. The TSICM was deployed as a paper- and web-based checklist.

Data Collection

The school district used in this study was located in a small town in a Midwestern state. The school district had a total enrollment of almost 2,200 students in grades K-12 with 147 certified teachers. Computer technology was used in all the schools in the district. All schools except the high school had computer labs and all teachers had classroom computers.

The school district had made a substantial investment in computer technology and was beginning a district-wide technology professional development initiative. To collect data regarding computer technology implementation occurring among teachers, all teachers at all grade levels were provided with a paper version of the *TSICM* checklist and the option to complete a web-based version of the *TSICM* checklist on the school district web site. The checklist was designed in a multiple-choice format in which respondents could select more than one response for each *TSICM* component.

Data collection occurred at both the start and end of a school year. A usable TSICM was completed by 70 teachers at the start of the school year and 84 teachers at the end of the school year. 57 teachers completed both the start and end of year administration of the *TSICM*.

Data Analysis

The rubric for recording teacher responses on the checklist was to rate to the highest level of use for each component on the checklist. The responses to the *TSICM* checklist were analyzed by cluster analysis to identify relatively homogenous groups of cases based on the *TSICM* components. Discriminant analysis (DA) was then used to assess the adequacy of the groupings from the cluster analysis by using the *TSICM* implementation components as predictor variables. A step-wise methodology was used to enter variables into the discriminant functions. One-way analysis of variance was used to determine if the component attributes of each group were statistically significant. Comparisons were made between the start and end of year data collections using a paired-samples *t*-test. Descriptive statistics for the data collections are provided in Table 1.

Table 1. Descriptive Statistics for Start and End of Year Administration of TSICM.

TECHNOLOGY STANDARD	Start of Year Administration (N=70)			End of Year Administration (N=84)		
	SUM	MEAN	STD. DEV.	SUM	MEAN	STD. DEV.
1. Operate common technology input devices.	217	3.10	.82	313	3.73	.73
2. Perform basic file management tasks.	206	2.94	1.11	316	3.76	.63
3. Apply trouble-shooting strategies and install software.	226	3.23	.87	318	3.79	.70
4. Use software productivity tools.	182	2.60	1.34	297	3.54	1.01
5. Use technology to communicate and collaborate.	228	3.26	.72	316	3.76	.59
6. Use technology to collect data and perform research.	188	2.69	1.10	286	3.40	.95
7. Model responsible use of technology.	174	2.49	1.42	274	3.26	1.13
8. Facilitate regular student use of computer technology.	208	2.97	1.45	257	3.06	1.43
9. Conduct learning activities using computer technology.	187	2.67	1.43	234	2.79	1.46
10. Select appropriate technology resources for classroom use.	83	1.19	1.33	194	2.31	1.69
11. Evaluate the validity of data collected using technology.	22	.31	.91	93	1.11	1.69

12. Use technology to present classroom instruction.	154	2.20	1.16	235	2.80	1.23
13. Integrate technology -based learning experiences into classroom instruction.	138	1.97	1.43	207	2.46	1.48
14. Use computer technology for problem-solving and critical thinking.	118	1.69	1.48	199	2.37	1.48
15. Use technology to facilitate individualized/cooperative learning experiences.	94	1.34	1.39	157	1.87	1.40
16. Assess student use of technology using multiple methods of evaluation.	66	.94	1.57	91	1.08	1.53
17. Develop and maintain electronic student portfolios.	23	.33	.88	48	.57	1.01
18. Use computer technology to maintain and analyze student performance.	136	1.94	1.23	224	2.67	1.08

RESULTS

Since the initial cluster centers and the number of dominant patterns were unknown, cluster analysis was performed on the first administration of the TSICM using all 18 components of the TSICM and incrementing the number of clusters until a reasonable model was obtained. The cluster analysis was run for 2, 3, 4, and 5 clusters before a reasonable model was selected. A reasonable model occurred with the number of clusters set at 3. When the number of clusters was set at 3, the number of cases in Group 1 was 21, Group 2 was 33, and Group 3 was 16. In order to make comparisons between the start and end of year data, this same grouping model (3 clusters/groups) was used for analysis of the end of year data collection.

In order to assess the adequacy of the classification of implementation pattern groups by the cluster analysis a Discriminant Analysis (DA) was performed. The 18 TSICM components were used to separate the groups into the discriminant functions. As a result of this procedure 97% of the cases or 68 of 70 cases were correctly classified. The DA reclassified 1 case in Group 2 for Group 3 and 1 case in Group 3 for Group 2.

The TSICM components were entered into the DA using a stepwise model in order to discard variables that were weakly related to group distinctions. Table 2 identifies the unstandardized discriminant coefficients for each TSICM component that best predicted the discriminant functions for the start of the year administration. Based on the discriminant coefficients, Component 13—Integrate Technology-based Learning Experiences into Classroom Instruction made the most important contribution to Function 1 and Component 8—Facilitate Regular Student Use of Computer Technology made the most important contribution to Function 2. Teachers identified with Group 1 (Technology Operators) were characterized by low or inverse relationships to Functions 1 and 2, Group 2 (Technology Facilitators) by high Function 2, and Group 3 (Technology Integrators) by high Function 1.

Table 2. Canonical Discriminant Function Coefficients.

	Function	
TSICM Component	**1**	**2**
8. Facilitate regular student use of computer technology.	.196	.756
9. Conduct learning activities using computer technology.	.471	.072
10. Select appropriate technology resources for classroom use.	.415	-.496
12. Use technology to present classroom instruction.	.177	-.539
13. Integrate technology -based learning experiences into classroom instruction.	.590	.402
16. Assess student use of technology using multiple methods of evaluation.	.408	-.716
18. Use computer technology to maintain and analyze student performance.	.175	.568

A cluster analysis was performed on the end of year data collection with the number of clusters set at 3 to compare with the clusters from the first of year data collection. With the number of clusters set at 3, the number of cases in Group 1 was 35, Group 2 was 18, and Group 3 was 31. The DA was repeated for the end of year data collection of the *TSCIM* to make comparisons with the first of year data collection. As a result of this procedure 92% of the cases or 77 of 84 cases were correctly classified. The DA reclassified 1 case in Group 1 for Group 2 and 6 cases in Group 3 for Group 1. Table 3 identifies the unstandardized discriminant coefficients for each *TSICM* component that best predict the discriminant functions for the start of the year administration of the *TSICM*. Based on the discriminant coefficients, Component 9—Conduct Learning Activities using Computer Technology made the most important contribution to Function 1 while Component 1—Operate Common Technology Input Devices made the most important contribution to Function 2. Teachers identified with Group 1 (Expert Technology Users/Operators) were characterized by high Function 2, Group 2 (Beginning Technology Users/Operators) by low or inverse relationships to Functions 1 and 2, and Group 3 (Technology Facilitators) by high Function 1.

Table 3. Canonical Discriminant Function Coefficients.

TSICM Component	Function 1	2
1. Operate common technology input devices.	.317	.764
9. Conduct learning activities using computer technology.	.614	.540
10. Select appropriate technology resources for classroom use.	.409	-.146
11. Evaluate the validity of data collected using technology.	.531	-.774
14. Use computer technology for problem-solving and critical thinking.	.602	.287

Paired samples correlations for each of components of the *TSICM* (technology standards) were computed for matched cases on the start and end of year administrations of the *TSICM*. (see Table 4). Almost all components of the *TSICM* indicated significant differences on the *t*-test ($p<.05$) between the start and end of year administrations. Additionally, paired samples correlations were computed when *TSICM* components were grouped by skill set or phase (see Table 5) and significant differences on the *t*-test ($p<.05$) were indicated for all three phases.

Conclusions

An interesting conclusion we deduced from the start of year data collection for this population of teachers was that proficiency in the use and operations of computer technology (Phase 1) was not necessarily a distinguishing attribute of high quality technology integration. Differences among the groups in this study at the beginning of the school year were delineated more by attributes of technology integration than by technology use and operations. This finding had relevance for the provision of technology professional development activities. These results clearly demonstrated that technology training activities for this school district needed to focus more on instructional strategies and methods to integrate technology in the classroom than on training activities to increase skills in the operation of computer hardware and use of software applications.

Table 4. Paired Samples Correlations by Technology Standard for Start and End of Year Administrations of TSICM (N=57).

TSICM Component (Technology Standard)	Correlation	*t*
1. Operate common technology input devices.	.273	-4.375*
2. Perform basic file management tasks.	.190	-4.169*
3. Apply trouble-shooting strategies and install software.	.330	-4.119*
4. Use software productivity tools.	.260	-5.314*
5. Use technology to communicate and collaborate.	.094	-2.950*
6. Use technology to collect data and perform research.	.002	-2.713*
7. Model responsible use of technology.	.419	-4.158*
8. Facilitate regular student use of computer technology.	.659	-.882
9. Conduct learning activities using computer technology.	.696	-1.135
10. Select appropriate technology resources for classroom use.	.374	-4.820*
11. Evaluate the validity of data collected using technology.	.373	-3.853*
12. Use technology to present classroom instruction.	.379	-3.340*
13. Integrate technology-based learning experiences in classroom instruction.	.586	-3.040*
14. Use computer technology for problem-solving and critical thinking.	.596	-4.428*
15. Use technology to facilitate individualized/cooperative learning experiences.	.485	-2.573*
16. Assess student use of technology using multiple methods of evaluation.	.474	-.338
17. Develop and maintain electronic student portfolios.	.581	-2.379*
18. Use computer technology to maintain and analyze student performance.	.320	-2.982*
Total Score All Standards	.708	-7.447*

*Significant at .05 level for two-tailed test

Table 5. Paired Samples Correlations by Type or Technology Standard for Start and End of Year Administrations of TSICM (N=57).

Skill Set/Phase of Technology Integration	Correlation	*t*
Using and Operating Technology in the Classroom	.441	-6.777*
Facilitating and Managing Classroom Technology	.746	-6.141*
Integrating Classroom Technology	.638	-4.058*

*Significant at .05 level for two-tailed test

By the end of the school year, the characteristics that delineated differences among the teachers in technology integration was more sharply defined by teachers who were beginning or expert operators of computer technology and those who were facilitators and managers of classroom technology. Thus, there was a clear progression among the teachers from technology operations to technology facilitation. While the technology professional development program at the school did not make technology integrators out of all participants, it clearly accommodated reasonable growth and advancement in the technology integration skills of the participants. When we considered only those teachers for whom we had both start and end of year data, a significant pattern of growth across standards and at all skill levels was indicated. This observation suggests that when educational best practices for teaching and learning with technology are clearly defined and established, the professional skills of teachers will begin to exemplify the stated expectations.

We have learned from this study that classroom technology integration was not so much about the quantity of teacher interactions with technology, but rather it was about the quality of teacher interactions with technology. When teacher interactions with technology were accompanied by expert teaching practices and related to curriculum objectives, the quality of technology integration was increased. Over time we have refined our technology integration professional development model to include more powerful technology integration strategies in classrooms beyond that of computer technology use and operations. We have learned that through the establishment of a well-defined set of pedagogical standards and indicators, higher levels of technology integration in classrooms can be identified and achieved. Consequently, when teachers know how to use and then actually use all the tools at their disposal, classroom pedagogy is expanded and improved.

Although many school districts have established benchmarks or standards for the integration of technology in classrooms, no model or methodology exists for substantiating technology standards with actual classroom practices. The *TSICM* represents a flexible and adaptable approach to the evaluation of technology integration in classrooms because the *TSICM* components reflect a set of widely-used standards that can be contextualized.

A methodology to provide comprehensive and continuous analysis of technology implementation is needed to sustain high levels of use and integration of computer technology in classrooms. This study demonstrated that the *TSICM* is an effective tool to determine technology integration in classrooms, to reveal the technology integration characteristics of teachers integrating technology in classrooms, and to distinguish appropriate technology training themes that focus on specific technology standards.

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Critical Examination of the Use of Online Technologies in Diverse Courses at a Large Comprehensive University

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Abstract

We explore cases of three classes that implemented online teaching / learning technologies as part of a university wide faculty development grant program. We examined students' satisfaction with key components of the learning experience. Instruments included students' pre-assessments and post assessments, an instructors' post survey, course syllabi, grant proposals, and instructors' end of grant reports. We present implications for campus wide implementation of online teaching/ learning technologies. We include discussion of a model for implementing innovative technologies campus wide (online teaching support model).

Background

In 1997, faculty interest in online teaching at California State University San Bernardino (CSUSB) started increasing. By 1999, the number of faculty who wanted to do online teaching had grown significantly. Faculty faced many questions and issues as they embarked to do online teaching. The Teaching Resource Center (TRC), the faculty development unit that support teaching and innovative instruction, also faced the task of helping in faculty's new role as online teachers.

To address these needs, TRC drew upon instructional design and evaluation models (Van Slyke, Kittner & Belanger, 1998; Belanger & Jordan, 2000; Dick & Carey, 1996; Salisbury, 1996; Seels & Glasgow, 1998) and identified the major steps involved in course development as applied to online teaching. TRC developed a systematic and holistic plan that serves both as the map and the glue that holds the various phases and players together (Santiago, 2001). This systematic plan has 7 major steps:

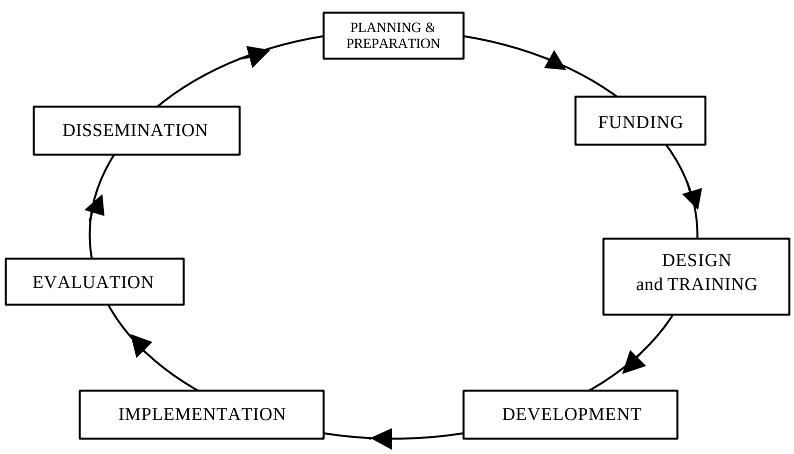

Figure 1. Online Teaching Support Model: 7 Major Steps

<u>Planning and Preparation.</u> The instructor studies the big picture and the instructional and non-instructional issues that will have an impact on successful online teaching. Addressing issues up front gives a good estimate of how much time and effort need to be invested, and helps determine one's readiness for online teaching.

<u>Funding</u>. Faculty are encouraged to seek funding through grant programs that lead to a course buyout, money for resources and/or hire a student assistant

<u>Instructional Design and Training:</u> Designing lessons for online teaching is not simply converting existing materials into digitized format. Skills and training for goal analysis, task analysis, assessment, instructional materials development, and the use of hardware and software are addressed in this step.

<u>Instructional Materials Development and Testing</u>. This step involves developing instructional materials, testing them, and making sure that they can be delivered successfully online, and that users will be able to access them with minimal, if not totally free of instructional and technological glitches.

<u>Implementation.</u> The course is actually taught online. The instructional design is put into action, the instructional materials are used, and technology is relied upon to deliver instruction, all towards the achievement of learning goals.

Evaluation. Evaluation identifies the strengths and weaknesses of the instructional design, of instructional materials, and delivery medium. Most importantly, it measures the extent to which goals were met.
Dissemination. Innovation and change that is well planned and appropriately evaluated also results in lessons learned and quality products. When reported to a professional community, this leads to further validation, peer evaluation, and replication, which then leads to scholarship of teaching (Hutchings and Schulman, 1999).

Description of Grant Program

To support online teaching, TRC sponsors the Web-based Course Development Grant program that awards summer stipend ($5,000) to faculty. The course redesign or development could range from using a significant combination of online features as teaching enhancement, or to deliver the whole course online. When first offered in 1999, 12 faculty proposals were funded. The Course Development Grant Program was funded by the Office of the Provost. Administrative support for online teaching also resulted in student support through the Student Technology Support Center, the establishment of an Office for Distributed Learning and the hiring of a librarian to support distance courses.

Analysis of the Efficacy of the Grant Program

To inform our analysis of the efficacy of the online components of the courses, we utilized a variety of assessment tools including pre and post surveys of students, a post survey of faculty, and an analysis of course syllabi, grant proposals and final reports.

Comparison data from the three classes in which we had sufficient data from both the student pretest and posttest are listed below. We report results from a comparison of the uses of online technologies in the three courses. We examined student data (pretest and posttest), faculty data (free response and multiple choice questions), course syllabi, and the course development proposal. Our intention was to utilize triangulation in an attempt to ascertain factors that led to successful and efficacious uses of online technologies from both the faculty and the student perspectives.

Three classes that were offered in the 1999-2000 academic year were examined. The description of each course is listed as it appeared in the course syllabi and/or the catalog of programs:

1. English as a Second Language (EESL) – Research in English as a Second Language: Covers various perspectives used to guide research in TESOL. Includes analysis, discussion, reflection and writing about key issues and concepts in research. Students will design and carry out literature review working towards a theoretical framework to gain foundation as expert practitioner or future researcher.
2. Criminal Justice (CJUS) – Research Methods in Criminal Justice: Introduction to scientific methodology and research designs used to conduct basic and applied research in the criminal justice field. Emphasis on scientific operationalization, survey methodology, and concepts of evaluation design.
3. Information Sciences (INFO) – Decision Support Systems: Formal information systems that support organizational decision-making. Topics include the strategy, framework, design, implementation and evaluation of decision support systems. Students will create and apply decision support systems to planning, coordinating, organizing, controlling and/or directing tasks.

Pre-Survey

In the student pre survey, we obtained data on three categories: student demographics, student background, and student experience on the use of technology. A summary of demographic data for 61 students who took the pretest in the 3 classes is listed below.

Table 1. Student Demographics

Demographics

		CJUS	EESL	INFO
Level	Graduate	3%	91%	5%
	Senior	40%		90%
	Junior	47%		5%
Degree sought	Masters	10%	100%	15%
	Bachelors	90%		75%
Age	40's & 50's		27%	20%
	30's	7%	45%	15%
	20's	87%	27%	65%
Gender	Male	43%	18%	45%
	Female	53%	82%	55%
Miles from campus	> 50 mi.	10%	18%	5%
	40-49 mi.	3%	9%	10%
	30-39 mi.	17%	0%	20%
	20-29 mi.	17%	9%	5%
	10-19 mi.	20%	0%	15%
	< 9 mi.	27%	55%	40%

Table 2. Student Background

Background

		CJSU	EESL	INFO
Reason for taking course	Recommended	27%	9%	25%
	Required	83%	100%	70%
	Interesting	17%	18%	30%
	Fits schedule	37%	18%	60%
Hours to spend on course	>= 17 hrs	3%	36%	0%
	13-16 hrs	3%	9%	0%
	9-12 hrs	23%	36%	10%
	5-8 hrs	57%	18%	75%
	0-4 hrs	13%	0%	15%
Same instructor before	Yes	37%	73%	10%

As shown above, the majority of the students were in upper division working for a bachelor's degree except for the Education masters students (EESL). Most of the students were in their 20's and 30's. Female students were in the majority, especially in the Education course. Almost half of the students live close to campus (< 9 miles) except for the CJUS students who are distributed in various distances from campus.

For background data, we surveyed students' reasons for taking the course, the number of hours that they intended to spend on the course per week, and whether they have had the instructor before. Data from this component of the survey is listed below.

In general, students were taking the course because it was required. A secondary reason was that it fits their schedule. The majority of the undergraduate students planned to spend 5-12 hours per week on the course, with graduate students planning to spend more than 17 hours per week on their course. Most of these graduate students have had a course with the instructor before.

We also surveyed students' use of and comfort level with online technologies. A summary of students' use of technology is given below:

Table 3. Student Use of Technology

Use of technology		CJUS	EESL	INFO
Access at home	Computer	93%	91%	100%
	Internet	87%	91%	90%
Used in previous course	Online syllabus	47%	73%	40%
	Online Lectures	33%	73%	30%
	Online Tests	7%	82%	20%
	Online Research	70%	91%	80%
	Online Discussion	10%	36%	20%
	Email	77%	91%	80%
	Chat Rooms	23%	9%	25%
Comfort level	Using computers	4.3	4.0	4.8
(5=highest)	Using internet	4.3	3.9	4.7
	Using Chat Rooms	3.2	3.4	4.1
	Using Email	4.1	4.6	4.6
	Taking Online Course	3.2	3.8	3.6
	Joining Online Discussion	2.8	3.5	3.7

Based on the data, student access to computers and Internet at home is very high (87-100%). Of the three groups, the graduate students had the most experience in the use of online technology in a course. Online experience is high for research and email use in all three courses. Students are most comfortable in the use of computers, Internet and email.

Post-Survey

In the student post survey we coupled the internally developed and tested Student Evaluation of Learning Effectiveness (or SELE, a self report measure of learning that utilized a 5 point Likert scale and which had been approved for use in evaluation of teaching by the Faculty Senate), with a self-report instrument concerning technology use in the course.

One particularly striking result involves the post survey item concerning how well the online learning experiences fostered interaction and teamwork among class members. In INFO, this was unmistakably the most highly rated item (mean = 4.5 of 5). In the other two courses, EESL and CJUS, this was clearly the lowest rated item (mean = 3.1 of 5, mean = 2.9 of 5, respectively). In comparing scores of both EESL and CJUS with INFO, two tailed t-tests indicated significance with p<. 01.

Table 4. Online Components of Course Fostered Interaction and Teamwork

		CJUS	EESL	INFO
Course fostered interaction and teamwork	5=Excellent	29%	18%	59%
	4=Very Good	0%	9%	35%
	3=Satisfactory	21%	45%	6%
	2=Poor	29%	18%	0%
	1=N/A	21%	9%	0%
	Mean	2.9	3.1	4.5

We found the highest mean posttest scores in the answers to three questions that related to the structure of the courses and to the involvement of the teacher in the learning process.

Table 5. Satisfaction With Course Items Controlled by Instructor

		CJUS	EESL	INFO
Matched objectives with assessment	5 = Excellent	50%	27%	41%
	4 = Very Good	36%	36%	47%
	3 = Satisfactory	7%	36%	12%
	2 = Poor	0%	0%	0%
	1 = N/A	7%	0%	0%
	Mean	4.2	3.9	4.3
Utilized clear grading criteria	5 = Excellent	43%	55%	47%
	4 = Very Good	36%	0%	41%
	3 = Satisfactory	14%	27%	12%
	2 = Poor	0%	18%	0%
	1 = N/A	7%	0%	0%
	Mean	4.1	3.9	4.4
Instructor contributed to learning	5 = Excellent	43%	36%	35%
	4 = Very Good	50%	36%	53%
	3 = Satisfactory	0%	27%	12%
	2 = Poor	0%	0%	0%
	1 = N/A	7%	0%	0%
	Mean	4.2	4.1	4.2

Table 6. Did Online Components Foster Discussion on Multicultural and Diversity Issues?

Fostered discussion on multicultural and diversity issues

	CJUS	EESL	INFO
5 = Excellent	29%	27%	18%
4 = Very Good	14%	18%	35%
3 = Satisfactory	21%	36%	29%
2 = Poor	14%	18%	18%
1 = N/A	21%	0%	0%

To the question: "The course matched objectives with assessment", the mean for CJUS was 4.2, for EESL, it was 3.9, and for INFO, it was 4.3. "Utilizing clear grading criteria was also rated high by all three courses, with INFO mean at 4.4, CJUS at 4.1 and EESL at 3.9. All three courses had almost the same means for the question "Instructor contributed to learning" (CJUS = 4.2, EESL = 4.1, INFO = 4.2). In tandem, this data would be an indicator of clear grading criteria that connected with stated objectives of the courses.

The lowest means reflected responses to whether the online components of the course "Fostered discussion on multicultural and diversity issues".

When it came to identifying who contributed to the learning experience, the instructor was ranked highest, based on the mean scores. EESL ranked "self" equally with the instructor, while CJUS ranked "self" as second and other students as lowest. Interestingly, concerning who contributed to their learning, INFO ranked "Other student/s" equally with the instructor. For both CJUS and EESL this was the lowest rated item of the three.

Table 7. Rating For How Well the Instructor, the Student, and Other Students Contributed to the Learning Experience

Contributed to learning experience	CJUS	EESL	INFO
Instructor	4.2	4.1	4.2
Self	3.6	4.0	4.0
Other Student/s	3.4	3.5	4.2

We also surveyed how satisfied students were with online course materials. Satisfaction was rated high by all three courses. However, when asked if on line materials helped facilitate learning, means for all three courses were low.

Table 8. Online materials survey results

	CJUS	EESL	INFO
Satisfied with online materials	4.7	4.1	4.2
Online materials facilitated learning	2.3	3.4	3.5

For all 3 courses examined, online materials were reported to have saved students time. However, in the EESL class, students reported spending more time on the online tests but saving time through use of discussion board.

Table 9: Time Spent/Saved Using Online Components

Time Spent					
	Online Materials		CJUS	EESL	INFO
		Saved time	36%	64%	69%
		Spent more time	0%	9%	6%
		No answer	64%	27%	13%
	Online Tests				
		Saved time	0%	27%	0%
		Spent more time	0%	55%	0%
		No answer	100%	27%	100%
	Discussion Board				
		Saved time	7%	64%	0%
		Spent more time	0%	9%	0%
		No answer	93%	27%	100%

Faculty Syllabi, Proposals, Grant Reports, and Post Surveys

The faculty post survey was composed of items concerning their needs and uses of online technologies, coupled with an evaluation of students' learning that paralleled the student post survey. We also examined how the use of online technologies impacted faculty workload.

In our ongoing analysis we are considering the factors that led to successful and efficacious use of online technologies for both faculty and students. We are currently conducting our analysis via triangulation where we compare student data, faculty data (composed of free response and multiple choice questions), information provided in the course syllabi, the grant proposals, and the end of grant reports.

We were not able to directly correlate the faculty post data with the student post data for individual courses due to the anonymity of the faculty post surveys. However, we were able to glean some data in the aggregate for professors' general satisfaction with the use of online technologies in their classes. Based on that data it was clear that faculty appreciated the support that was given to them.

Two of the three instructors provided access to syllabus information. Based on this information, in the INFO class, students were required to work in teams to complete projects. The professor used online materials but did not list use of the discussion board in his syllabus. By contrast, in the EESL class, students were not required to work in teams. The instructor required the use of the discussion board, online materials and online tests.

Table 10: Online components of Course Design

COURSE DESIGN	Based on Proposal:			Based on syllabus:			Based on final report:		
	CJUS	EESL615 EESL	INFO	CJUS	EESL	INFO	CJUS	EESL	INFO
Online Materials	All course notes, exercises	Information modules/ tutorials using PowerPoint and audio	Course content, glossary, site links for articles		Assignment descriptions			Course materials	Course content
Online Tests	Practice quizzes, assessment	Part of tutorial	Online quizzes and surveys		100-point quiz set, review quizzes			Quizzes	
Online Research					Accessing TESOL research via technology				

Online Discussion				
Email				
Chat Rooms	Mentioned in the justification but not part of project description			Mentioned it affords students to interact but was not reported to have been done
Bulletin board		Weekly announce-ments	Used extensively	

In the grant proposals, teaching was to be enhanced with the posting of online materials and links to relevant websites (see figure 10). EESL also incorporated the use of online tests and discussion board. INFO proposed to implement more technologies than were actually incorporated into the course.

Discussion

Based on the data presented above, it appears clear that in all three courses, students were satisfied with the connections made between the objectives of the course and the assessments used. This would imply that the courses were relatively well designed.

However, though the courses were relatively well received, it appears that improvements could have been made in the effective use of online technologies. For instance, the INFO course did not, according to the syllabus, the final report and the students' post surveys, use a discussion board for collaboration and file sharing. This was the case even though extensive collaboration was necessary for successful completion of course projects and even though at least 40% of the students lived 20 or more miles from campus.

Myer (2001) indicated that a fundamental problem with much research on online instruction is that it has failed to disaggregate the effects of the instructional design from the effects attributable to the technology. This appears to be the case in the courses that we examined above, as each could be shown to have been efficacious (based on student post survey data).

It is striking that two of the three courses did not reflect good scores on online learning activities fostering interaction and teamwork. This is striking as online technologies such as threaded discussion boards and chat rooms can be very powerful tools for collaboration (see Jonassen, et al., 1999). This would suggest that the full power of the technologies available through the WebCT tools to the instructors had not been utilized. In the third course, the INFO course, it is not clear whether chat rooms were utilized by students (see table 10). However, the structure of the course required extensive collaboration on projects (according to the course syllabus).

Similarly, for all three classes, the mean scores on facilitating discussions concerning diversity were low. Online technologies have the potential to enable ready access to global perspectives (see Papert, 1998), yet it would appear that this characteristic of the technology was not utilized effectively.

The fact that students in all three classes generally believed that using online technologies saved time would suggest improved instructional efficiency for all classes. With a population composed of commuters, who often hold full time jobs, this result is weighty.

Though we asked students to rate how well the online learning experiences (using 5=excellent; 4=very good; 3=satisfactory; 2=poor; 1=not applicable), contributed to the effectiveness of the class (as measured by multiple items detailed in the above tables of results), respondents may not have read the items with respect to online technologies but rather with respect to the entire class. For instance, in the INFO class, students identified online components of the class to have contributed to fostering interaction and teamwork, yet a discussion board was not utilized in the course, according to the proposal, the syllabus, the final report, and student post surveys. We are also concerned that in some cases, students may not have understood the terms used and may have therefore answered questions erroneously (e.g. some students rated discussion boards and chat rooms that did not appear to have been implemented in a particular course).

Given our data analysis, several implications are suggested for implementation of the Online Teaching Support Model at our university. In examining the 7 components of the model, there is evidence that several of the components may require substantial additional support. Specifically, the instructional design and training area may need additional attention to enable faculty to best integrate online technologies into their course design. We are concerned that our evidence suggests that instructors may not use the most powerful or appropriate technologies to assist with learning outcomes for their class or that they may use technologies in ways that are not effective. Additionally, in the evaluation area, several flaws were present. Faculty did not administer the instruments consistently in their courses (even though evaluation was a critical component of the grant). Thus, of the twelve funded projects, we were able to realize comparison data from only three classes in which we had sufficient data from both the student pretest and posttest.

We surmise that, in general, there is a tendency for faculty to focus on innovation and on technology and not on evaluation of the online course components. In order to better collect data from faculty, and to encourage them to have students participate fully in pretest and posttest administration, additional faculty incentives and reminders are likely to be necessary. Engaging faculty in a post-course interview would also likely assist analysis of the efficacy of the online course components.

We will apply the lessons learned from this analysis to future faculty development grant projects. This will assist us in serving the educational needs of our students through the use of technologies that can bridge barriers to access. We believe that the Online Teaching Support Model can be effectively applied at other institutions that would internally fund faculty development efforts. Based on our experience, special attention should be applied to the instructional design and evaluative components of such efforts.

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Online Collaborative Documents for Research and Coursework

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Abstract

Online collaborative documents can be used effectively for conducting collaborative research and for learning collaboratively via the Internet. Collaborative documents are dedicated online workspaces that allow individuals or groups to use the Internet to share their work with others, edit it, and finalize it. This paper identifies Basic Support for Cooperative Work and FirstClass as Internet tools that have enabled collaboration across distance for both research and coursework, and it provides real-life applications of those tools in higher education.

Introduction

We use online collaborative documents for conducting collaborative research and for learning collaboratively via the Internet. The increased use of the Internet in higher education has allowed researchers to conduct collaborative research and faculty to provide opportunities for students to work collaboratively in their courses. Collaborative documents are dedicated online workspaces that allow individuals or groups to use the Internet to share their work with others, edit it, and finalize it. Real-time chats, computer conferences, and email may be used to support collaborative documents but are not collaborative documents according to our definition because they are not dedicated workspaces.

Collaborative learning is an instructional method in which small groups of learners work together to accomplish shared goals (Slavin, 1994). Similarly, computer-supported collaborative work allows working groups distributed in time and space to use groupware. Various Internet tools have enabled collaboration across distance for both research and coursework.

Collaborative Documents for Research

Since the advent of email, and fax, researchers across distances have used telecommunications to write documents together—getting feedback from co-researchers and incorporating those ideas into the manuscript. Eventually, through multiple- iterations, the document becomes a final product. The early Internet researchers had to think creatively so that their co-collaborators could discern the changes made to the document. For example, in 1991 two researchers co-authored a book chapter using boldface type, square brackets, and initials and dates via email between their two universities (Murphy & Rogers, 1993).

Electronic bulletin board systems and computer conferencing software such as Wildcat, VAXNotes, LotusNotes, and Web boards allow users to hold asynchronous, threaded discussions online. Through such server software, co-researchers can share their ideas in an organized manner without using their own disk space. Most of the early software programs did not allow attachments. More recently, we have used several Web tools with shared workspaces for conducting our research: Basic Support for Cooperative Work (BSCW) because of its capabilities for file attachments and version control; and FirstClass computer conference software because of its asynchronous and synchronous communication, file transfer, and collaborative document functions. See Table 1 for shared characteristics and Table 2 for differences between BSCW and FirstClass.

Table 1. Shared Characteristics of BSCW and FirstClass

Server-based
Individual and collaborative workspaces
Text-based
Asynchronous threaded discussions
File attachments
Links to Internet
Cross-platform

Table 2. Differences between BSCW and FirstClass

BSCW	FirstClass
Free	Requires a license
Web accessible	Web and client accessible
Icon and menu driven	Graphic user interface
No synchronous chat capability	Synchronous chat capability
Automatic version control	Manual version control
Steep learning curve	Short learning curve
Complex organization	Simple organization
Meeting notification	Special forms

BSCW description and research examples

The process of file attachments and version control in BSCW is relatively simple. Researcher 1 first attaches a file in a workspace and then establishes version control on the file. Researcher 2 then downloads the file, uses typical editing functions (e.g., colored font, boldface type, comments in brackets, dates), saves it, and uploads it to the dedicated workspace. All versions of a document are maintained in the workspace without being over-written. Although the researchers do not rename the file as they upload it, the BSCW software automatically assigns the new file with a new version number and names the author of that version. When multiple collaborators create a document, this process of version control keeps track of multiple iterations. The primary disadvantages of using BSCW are its steep learning curve and a slow rate of speed in updating Web pages due to the extensive graphics on the BSCW Web site.

Researchers have used BSCW for shared research in co-authoring papers and manuscripts between two countries or cities. For example, prior to working on manuscripts when one would be in Taiwan and the other in the U.S., the second and third authors met face-to-face to establish the method of exchange and encountered the following problems only after one researcher traveled to Taiwan: (a) figures created on one platform did not always show up on another; (b) communication was interrupted when an undersea cable linking the United States and Taiwan was damaged; and (c) communication was delayed when Internet traffic was jammed in Taiwan. This Internet traffic worsened when students were out of school during vacations. Fortunately, the telecommunications company arranged for the net users to transmit data through a backup cable as well as a satellite-based network (Cifuentes & Shih, 2001; Hsu, 1999; Staff Reporter, The China Post, 2001). Similarly, the first author met face-to-face twice with two co-authors to brainstorm the method and later to analyze data, and they accomplished the remainder of the research using BSCW's version control to communicate between two cities in Texas (Murphy, Mahoney, & Harvell, 2000).

A second example of how researchers use BSCW for shared research is in guiding dissertation research. The first author designates a shared workspace for each of her doctoral students in her own workspace. The students are each responsible for posting drafts and final versions of their work in their workspaces for the dissertation chair to read, edit, comment, and guide the process. A typical doctoral student's BSCW workspace includes the following folders: Bibliographies, Discussions, Meeting Notes, Prelims and Orals, Proposal Components, Dissertation Components, and Resources. The researcher finds BSCW a convenient and powerful tool to track the progress of her doctoral advisees as well as share resources among the students.

FirstClass description and research examples

Researchers suggest that the very nature of computer conferencing—its capacity to support interaction among students—fosters a collaborative approach to learning (Harasim, Hiltz, Teles, & Turoff, 1995). FirstClass computer conference software provides multiple functions that foster collaborative research and learning: threaded discussions in icon-based conferences, file attachments, private email, real-time text-based chats (Persico & Manca, 2000), and collaborative document writing spaces. The text-based collaborative document writing spaces allow only one person to edit a document at a time, using word processing capabilities like font types, colors, and sizes. However, multiple readers can access these continuous unbroken documents simultaneously. Currently, the client version of FirstClass must be used in order to open and write in collaborative documents, as the Web version does not provide that capability.

The first author and several local doctoral students used FirstClass collaborative documents to prepare two conference papers (Murphy, Harvell, Epps et al., 1999; Murphy, Harvell, Sanders, & Epps, 1999). The shared workspaces provided the authors with "boundaries around a protected space, with the members of the group sharing a common experience" (Palloff & Pratt, 1999, p. 61). In both cases, the researcher was careful to save the collaborative documents to her hard drive daily, because such documents cannot be protected and still allow multiple users to access the document.

Collaborative documents for coursework

With the advent of the Web for course support or delivery, designing authentic and relevant activities that foster collaboration among learners has become a challenge for instructors and course designers (Carr-Chellman & Duchastel, 2000; Cifuentes, Murphy, Segur, & Kodali, 1997). Collaborative workspaces and documents facilitate a variety of learning activities in Web-based courses including tutorials (Cifuentes & Shih, 2001; Cifuentes & Shih, in press; Davis & Chang, 1994/95; Kamhi-Stein, 1997; Leh, 1997), small-group discussions, project-based work, collaborative problem-solving activities (Romiszowski, 1997), brainstorming (Kay, 1995; Neuhaus, 1997; Siau, 1995, 1996), and case-based learning (Ertmer & Quinn, 1998). In collaborative workspaces and documents in BSCW and FirstClass, learners can identify their contributions by dating and signing them and by using different colors. Because a FirstClass collaborative document is a continuous unbroken document that allows users to "get a holistic view of the activity without having to open and close numerous messages" (Murphy & Gazi, in press), learners find the tool easy to use for brainstorming and planning activities as well as for editing each other's work. In the following sections, we illustrate applications from our coursework of each of the preceding learning activities.

Tutorial

American and Taiwanese university students corresponded via e-mail and a Web-board to prepare U.S. preservice teachers for online teaching and reaching diverse learners, and to provide English instruction to the Taiwanese students. U.S. preservice teachers explored theory and practice of online instruction, corresponded as tutors to teach English language and American culture, and reflected upon their experiences. Taiwanese students practiced English and exchanged cultural information. Throughout the correspondence, the two parties made use of different strategies to achieve their predefined instructional and learning goals. The preservice teachers employed a total of seven online teaching strategies: (a) facilitative information, (b) questions and answers from tutor to student, (c) questions and answers from student to tutor, (d) topic discussion, (e) problem solving, (f) critique of writing, and (g) recommendations for metacognition. Similarly, the Taiwanese learners used ten online learning strategies: (a) responsive dialogue, (b) translation, (c) responding to tutors' questions, (d) asking questions of tutors, (e) explanation, (f) elaboration, (g) decision-making, (h) self-reflection, (i) metacognitive strategies, and (j) transfer (Cifuentes & Shih, 2001; Cifuentes & Shih, in press).

Small-group discussions

All online classes in our educational technology program, and most classes that are not online, include online discussion spaces. Students discuss course readings and learn how to moderate discussions on specific topics.

Project-based work

In an introductory instructional design course, students used FirstClass to conduct project-based work in small groups. Students work with a client and often with an online team to carry out the phases of instructional design. For instance, two students living in cities separated by hundreds of miles designed and developed teacher training on thematic-unit design for a school district. They shared design and development processes using a dedicated space in FirstClass. They established goals; designed instruments for analyses of the learners, context and goals; wrote objectives and developed assessment instruments, shared evaluation data, and assigned development tasks to each other in FirstClass.

Students in introductory distance learning courses at two universities used the FirstClass server at one of the universities to design, develop, and evaluate telecommunications-based case studies in small teams. Most teams scheduled regular online chats with their team members as well as working asynchronously in threaded discussions to collaborate on the project. Each group developed its own evaluation criteria, which the other groups used to evaluate its products.

In other courses students collaboratively produced instructional thematic units, Web pages, and computer graphics using FirstClass. In a class that focused on design and development of student-centered, technology rich thematic units (Roberts & Kellough, 2000), students teamed to develop those units. They brainstormed to agree on a theme for their team's unit and submitted contributions to the unit in the shared workspace. Contributions included readings of interest, PowerPoint presentations, WebQuests, ideas for telecommunications partnerships, and lesson plans.

Students also collaboratively created computer graphics by submitting those graphics to a team in a dedicated space in FirstClass. Team members could alter the PowerPoint presentations, PhotoShop files, and Director files and resubmit them with their embedded feedback and changes. In this way students were able to receive concrete feedback from both the instructor and fellow students in order to learn principles of effective design.

Collaborative problem-solving activities

For a survey course in educational technology, the instructor posed a simulated problem for students to address in FirstClass collaborative documents and threaded discussions. The instructor invented Mythica, a mythical oil-producing country comprised of 18 islands and inhabited by people accustomed to learning by rote memorization. The students' challenges were to answer questions related to the simulation and to submit a bid on a project for teaching English to the entire Mythica population. Three co-facilitators presented the simulation to two teams of their classmates, who responded to the questions in their collaborative workspaces. The teams competed for the winning bid by helping their teammates with refinements of their replies (Murphy, Moran, & Weems, 2000).

In a course about distance learning, students used FirstClass to complete training modules on Internet tools in dyads: a trainer and a trainee. The trainer first developed a training program for a specific tool, such as CU-SeeMe, and then delivered the training to the trainee via FirstClass as a pilot test. The trainee was responsible for giving feedback to the trainer regarding accuracy and clarity. After the trainer made the necessary revisions and the trainee approved them, the student Webmaster published the training programs on the Web for other students to access and use. In the final step of this process, the trainer and trainee individually recorded their reflections about the experience (Murphy, Harvell, Sanders, & Epps, 1999). In most cases, the more experienced Internet user was the trainer; however, some dyads reversed their roles so that the inexperienced user would gain more expertise.

Brainstorming

Students in a Computer Graphics for Learning course used a dedicated space in FirstClass to brainstorm ideas prior to creating instructional animations. The assignment was for each student to develop an animation that would help learners understand a complex concept. In previous semesters several students had submitted animations that were primarily cosmetic rather than instructive. In an attempt to hinder such submissions, the instructor set up a brainstorming conference in FirstClass. In that conference, students were requested to enter their ideas for instructive animations and they were allowed to give each other feedback regarding the value and attributes of such an animation. One student's idea led to many students' ideas, and ultimately all students formulated good ideas for meaningful animations.

Case-based learning

In an introductory instructional design course, students analyzed cases following recommendations for case analysis (Ertmer & Quinn, 1998). They negotiated meaning regarding the nature of the problems posed and potential solutions using FirstClass. Students discussed 24 ID cases according to key issues of the cases, key players' perspectives, potential solutions related to problems, and recommendations for action.

Conclusions

Garrison's (2000) review of distance education theories describes the current need for "sustained real two-way communication" (p. 13) to be at the core of the educational experience. Until recently, the field was dominated by organizational (structural) assumptions. However, with the advent of new methods and technologies, the field will "demand theories that reflect a collaborative approach to distance education…and have at their core an adaptive teaching and learning transaction" (p. 13). One way to apply such theories to research and coursework is to use collaborative documents to promote transaction culminating in deliberation among the key players. Such deliberation can create "a particular kind of democratic public culture among the deliberators: listening as well as talking, sharing resources, forging decisions together rather than only advocating positions taken earlier, and coming to disagreement" (Parker, Ninomiya, & Cogan, 1999, p. 129).

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Building Team Collaboration in the Virtual Classroom

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Abstract

The benefits of collaboration and team skills have long been recognized in both business and academic settings. In a study involving a team of business professionals performed in 1967, Maier concluded that teams have a distinct advantage over individuals in that they have a greater pool of knowledge, receive more input and solutions to problems, and encourage a better collective acceptance and understanding of group decisions. A more recent study of student teams concluded that team projects develop individual collaborative skills, strengthen both individual and group commitment to teamwork and prepare students for the 21st century workplace (Rooney, 2000).

In online collaborative learning situations, however, research suggests that team assignments can often frustrate and annoy students (Bowen, 1998). Teams must deal with new expectations, attitudes, boundaries, and responsibilities which can all cause clashes (Joinson, 1999). Further, since the tendency of online learners leans toward self-direction, students have a natural resistance to team projects where outcomes rely upon the input of others (Ko & Rossen, 2001).

Two investigators developed a web-based teambuilding instructional and activities module to improve the collaboration skills of team members involved in online collaboration. This module was formatively evaluated using 24 graduate students who were enrolled in an online course that assigned two online team projects during the Fall 2000 semester. The objectives of the investigation were: 1) to explore whether or not online learners valued the VTB instruction they received as preparation for online team projects, 2) to explore how online learners who received specific instruction on online teambuilding perceived their actual collaborative experiences as members of a virtual team, 3) to determine the online collaboration skills online learners gained after they had completed the module, and 4) to determine whether learners believed that they would use the online teamwork skills and knowledge they gained from the instructional module in future online collaborative teams.

Both quantitative and qualitative data indicated that students were satisfied with the teambuilding instruction and their virtual team experiences, gained online collaboration skills and indicated they would apply these skills to future online collaborative projects. These findings imply that educators who teach online graduate courses and assign online team projects should consider integrating online teambuilding instruction into their coursework and study the value of this instructional approach for their students.

Statement of the Problem

With the advancement of technology, online instruction that often involves team projects is becoming more prevalent (DeNigris & Witchel, 2000). As this trend is still fairly recent, there are major discrepancies between the available resources to increase the effectiveness of instructors who teach online and the resources available to instructors who teach face-to-face. Hara and Kling (2000) found that the quality, quantity, and accessibility of materials available to online teachers are inadequate.

Although there has been an increase in the frequency of educational teams, it has not been matched with adequate teacher training in collaborative group processes to promote team potential, team productivity, and team maintenance (Trimble & Irvin, 1996). Moreover, the members of teams could also use training in areas like team problem-solving, conflict management, and meeting management (Joinson, 1999; Mazany & Francis, 1995).

The title of this paper, *Building Team Collaboration in the Virtual Classroom*, uses two terms, *team* and *collaboration*, which may appear at first glance to be redundant. People do not become collaborators, however, merely because they are grouped into teams. Just like any other ability, effective collaboration involves a set of skills that needs to be learned and cultivated. This becomes especially important in a virtual realm where team members may not be able to meet face-to-face.

The benefits of collaboration and team skills have long been recognized in both business and academic settings. In a study involving a team of business professionals performed in 1967, Maier concluded that teams have a distinct advantage over individuals in that they have a greater pool of knowledge, receive more input and solutions to problems, and encourage a better collective acceptance and understanding of group decisions. A more recent study of student teams concluded that team projects develop individual collaborative skills, strengthen both individual and group commitment to teamwork and prepare students for the 21st century workplace (Rooney, 2000).

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Review of the Literature

Teambuilding Training

Barker and Franzak (1997) believe that it is "prudent" for educators to provide needed experience and information to prepare students to be better team members. For online teams, this training should also include technical support and technology training on the hardware and software used to support online teamwork (Duarte & Snyder, 1999).

Team training and development should also be ongoing to include teambuilding interventions that are matched to the specific needs of the team. For example, an intervention to improve problem-solving skills may have little impact on a team experiencing difficulties developing workflow processes. Similarly, McClure and Werther (1993) determined that specific team interventions that target personality characteristics assisted teams in identifying and resolving personality-based barriers by improving interpersonal communication and teambuilding.

Team lifecycles should also be carefully considered before implementing training. Teams exist on a continuum: from short-term project teams to relatively permanent teams (Tannenbaum, Beard, & Salas, 1991). Druskat & Kayes (2000) propose that many popular teambuilding models are inappropriate for short-term project teams. For example, the conflict depicted as inevitable during the "storming" stage of Tuckman's (1965) team-development model (i.e., forming, storming, norming, performing) might confuse or obstruct short-term project teams whose lifecycle is too brief to benefit from this information (Porter & Lilly, 1996).

Finally, in educational settings, teambuilding interventions that encourage establishing clear responsibilities, procedures, and due dates for team members may have some positive impact on team performance but may also reduce exploration or risk-taking among team members that they might otherwise use to seek answers and make decisions, which could compromise team learning (Druskat & Kayes, 2000).

Elements Found in Successful Teams

Successful teams share certain characteristics or traits. For the purposes of this investigation, these characteristics or traits were labeled "elements found in successful teams." These elements included receiving organizational or instructor support, becoming acquainted with team members, establishing effective communication, building trust, and developing effective online organization strategies (DeNigris & Witchel, 2000; Duarte & Snyder, 1999).

Receiving Support

The literature often cites organizational and management support as the major factor in team success (Berry, Avergun, & Russ-Eft, 1993; Haywood, 1998). In educational teams, a lack of support from the instructor causes anxiety and frustration among students and adversely affects team effectiveness (Hara & Kling, 2000). Oliver, Omari, and Herrington (1998) recommended that online instructors should *scaffold* their support to students. They describe *scaffolding* as providing increased support at critical times, such as at the beginning of instruction when students must learn new information or skills, and tapering off as students become more experienced.

The element, "support," encompasses providing encouragement, information, and resources; responding to team requests promptly; helping to provide team direction; acting as an arbitrator; and backing the decisions of teams (Duarte & Snyder, 1999; Eales-White, 1997; Haywood, 1998). In knowing what constitutes receiving support, team members can play a more active role in obtaining it.

Getting Acquainted

Berliner (1991) wrote, "education—even when carried out with personal computers—is an inherently social process" (p. 50). Although building relationships in online environments is difficult, it is essential to team effectiveness (DeNigris & Witchel, 2000; Haywood, 1998). Research has indicated a positive link between team member relations and team performance in both short-term teams (Druskat & Kayes, 2000) and in long-term teams (Druskat, 1996; Goodman & Leyden, 1991). The familiarity that individual members develop within their teams helps them to predict each other's behaviors and match their strengths and interests to tasks (Cannon-Bowers, Salas, & Volpe, 1995).

The element, "getting acquainted" encompasses sharing cultural information which includes sharing beliefs, values, assumptions, and opinions; personal information that includes sharing interests, hobbies, work life, family life, personal web site, hours of availability, personal expectations of the team, types of computer connections, equipment, and skills (Duarte & Snyder, 1999; Haywood, 1998).

Establishing Communication

Much of human communication is inherently ambiguous. In face-to-face situations, however, people are more apt to resolve these ambiguities. As Hara and Kling (2000) found in a study of graduate students who were taking an online course, resolving communication ambiguities can be much more difficult in synchronous and asynchronous online situations where the primary means of communication is written text. In a separate study of graduate students enrolled in an online educational technology course, Talley (1997) found two underlying problems specific to online communication and distance education: 1) students who easily communicate face-to-face found online contact more difficult due to limited typing skills, and 2) synchronous discussions required a speed of response and attentiveness that was demanding, while students generally prefer time to reflect on ideas before responding to them.

Establishing clear communication is fundamental to all aspects of online teams. For example, teams must communicate effectively in order to establish clear and specific goals and objectives so that they may function effectively as a team (Larson and LaFasto, 1989). Yukl (1994) maintains that teams that do not clearly communicate their goals will be fraught with disagreement about priorities and processes for accomplishing objectives.

Three ways to foster effective online communication include: 1) limiting interference which entails being prepared for online team meetings, being timely, using technology effectively, and asking questions when messages are unclear (Duarte & Snyder, 1999; Haywood, 1998); 2) encouraging open communication which entails being informal, incorporating humor, being honest and thoughtful, and providing motivational and positive messages to teammates (Duarte & Snyder, 1999; Hara & Kling, 2000); and 3) building rapport among teammates which entails occasionally engaging in team activities or discussions that are not work-related (Barker & Franzak, 1997, Oliver, Omari, & Herrington, 1998).

Building Trust

Geber (1995) determined that face-to-face contact was necessary to establish trust within teams. In a study of virtual organizations, Handy (1995) corroborated Geber's conclusion when he proposed that trust may not be possible in global virtual teams because it requires "touch," that is, direct face-to-face exchanges. Conversely, Jarvenpaa, Knoll, and Leidner (1998) found a positive relationship between the levels of trust and the amount of cohesiveness, satisfaction, and perceived effectiveness among online team members. According to Jarvenpaa and Leidner (1998), although the usual cues used to convey a sense of trust, such as warmth, attentiveness, and other expressive behaviors, are somewhat lacking in the virtual realm, experienced online team members display trust behaviors in other ways. That particular trust, however, is delicate and provisional.

While developing trust in a virtual environment requires a more conscious and planned effort (Duarte & Snyder, 1999), once it is developed, trust enhances group learning and development (Braaten, 1974; Mann, 1975) and it allows teams to manage conflict more effectively to become more productive and creative (Dee, 1995). Conflict is a reality of team experience and the willingness and ability to resolve personal conflict is crucial to team success (Hequet, 1994; McClure & Werther, 1993). Although several researchers recommended the golden rule, "treat others as you would like to be treated" for resolving conflict and building trust (Dee, 1995; DuBrin, 1995; Gardenswartz & Rowe, 1994). Kezar (1998) and Manz, Neck, Mancuso, and Manz (1997) suggested a somewhat modified golden rule that embraced the diversity found in online teams. They urge team members to discover how other people on their team want to be treated and then act accordingly.

In online teams, the element, "building trust" encompasses acting with integrity toward teammates, respecting others, committing to the team effort, resolving conflict constructively, being reliable, and being honest (Duarte & Snyder, 1999; Haywood, 1998; Iacono & Weisband, 1997).

Getting Organized

The research of Langer (1997) and Druskat & Kayes (2000) revealed an inverse relationship between clearly defined project goals and learning. Specifically, a decrease in structure and specifics of a project results in an increase in learning and vice versa. Langer (1997) describes this phenomenon as the need for "mindfulness" or thought and attention to changing ideas and circumstances, which, she argues, increases learning. Conversely, other studies involving project teams revealed that developing clear plans, goals, and priorities is positively associated with team efficiency (Ancona & Caldwell, 1992; Ko & Rossen, 2001) and performance (Porter & Lilly, 1996).

Duarte and Snyder (1999) described a virtual environment as inherently chaotic and advocate the use of clear procedures and organization guidelines within online teams. In their book on virtual teams, they outline several strategies, tools, and techniques to help online teams be more organized and, they argue, be more satisfied and successful. For example, they use checklists and worksheets to highlight critical success factors found in effective teams; they provide sample agendas to help confirm team missions; and they use scenarios and exercises to encourage spontaneous and reflective thinking to develop problem-solving skills.

In online teams, the element, "getting organized" encompasses selecting a team leader, recognizing and rewarding team accomplishments, facilitating team meetings, developing team norms, instituting workflow procedures, creating time lines, and selecting the appropriate technology and method for team interactions (Duarte & Snyder, 1999; Haywood, 1998).

Conclusion

Research that emphasizes the value to learners of online instruction that includes collaboration (Druskat and Kayes, 2000) coupled with findings concerning the discrepancies and poor quality of online resources available to instructors (Hara and Kling, 2000), underscore the need for developing more resources on online teambuilding.

The literature review also calls attention to the need for further research of virtual teams. Hara and Kling (2000) encouraged further research on the impact of support on students enrolled in online classes. They point to problems and disappointments of students who lack the support they need to be successful in online courses. Based upon this collection of research, guidance from instructors, content experts, and peers, a web-based instructional module on teambuilding was developed to aid both students and instructors who are involved in online courses which have team projects.

Methodology

During the Summer 2000, two investigators collaborated to develop a web-based teambuilding instructional module (module) to be used as part of an instructional design study. The investigators developed instruments to measure various aspects of learners before and after the learners completed the module. The purpose of the module was to improve online collaboration skills and attitudes of people who produced online projects as teams. The investigators worked together to implement the module and to gather data focusing on teambuilding skill levels of online learners and on general attitudes toward teambuilding instruction and the collaboration process.

Online Teambuilding Instructional Module

The online teambuilding instructional module consisted of an online *PowerPoint* presentation and an activity worksheet. It provided practical information and practice with elements found in successful online teamwork. These elements included information on receiving organizational or instructor support, becoming acquainted with team members, establishing effective communication, building trust, and developing effective online organization strategies. The instructional module created for this study followed a modified version of Dick and Carey's (1996) Instructional **System Design Model.**

The module was web-based and was accessible to learners via a virtual teambuilding (VTB) web site designed by the investigators. Learners who did not have high-speed Internet access were provided with a duplicate version of the teambuilding *PowerPoint* presentation that was downloadable to their computer desktop.

The web site housing the module also included a Pre-Course Survey and Post-Teamwork Survey. These surveys measured learner satisfaction with his or her team projects, and the skills they gained for online collaboration following the instruction they would receive from the module. Data on prior experience with relevant online collaborative technologies was also gathered using these surveys and was to be used to group learners of the study into teams for purposes of collaborating on team projects.

Objectives

There were four objectives for this study. The first objective was to explore whether or not online learners valued the VTB instruction they received as preparation for online team projects. This objective was measured in terms of: 1) online learner satisfaction with the two components that comprised the instruction: an online *PowerPoint* presentation on virtual teambuilding and a teambuilding activity worksheet, and 2) online learner perceptions of instruction as contributing to their individual personal growth as learners and educators.

The second objective was to explore how online learners who received specific instruction on online teambuilding perceived their actual collaborative experiences as members of a virtual team. This objective was measured in terms of online learner satisfaction with individual team experiences encompassing elements found in successful online teams: receiving support, getting acquainted, building trust, building communication, and getting organized.

The third objective was to determine the online collaboration skills online learners gained after they had completed the module. This objective was measured by comparing results from individual pre-course surveys with post-teamwork surveys that contained specific questions about knowledge and skill levels when working in online collaborative teams.

The fourth objective was to determine whether learners believed that they would use the online teamwork skills and knowledge they gained from the instructional module in future online collaborative teams. This objective was measured by the responses students gave concerning their attitudes toward using the online team skills they developed in future online collaborative situations.

Target Audience

The target audience for the teambuilding instructional module is adult learners who are engaged in online, collaborative projects as part of a virtual team. The ultimate intended purpose of the module is to be available to any person who has Internet access at anytime and at any location. Additionally, while it was written in English, the overall theme, the language, and graphics used throughout the module were specifically designed to be inclusive of other cultures.

Participants

This study addressed itself to a sample drawn from a group of graduate students who were enrolled in an online course. This course was being offered at the University of Hawaii, Manoa (UHM) for the Fall 2000 Semester. The instructor for this course had extensive experience with the content of the course and with distance learning. Course content, schedules, and feedback were given via an online university network called Web Course Tools (WebCT). This particular class was selected because it represented the target population in that it contained a mix of male and female adults from various ethnicities who were involved in online collaborative projects.

There were a total of 27 students enrolled in the online course—10 male and 17 female. The cultural backgrounds of the students were Chinese, Swedish, Hispanic, Japanese, Filipino, and Caucasian American. This module was administered to 24 of the 27 enrolled students. Two students opted not to participate and one student was disqualified because she was also one of the investigators. Although only the results of 24 of the 27 students were considered as part of the study, the whole class received the same treatment.

Procedures

This module was administered to all students enrolled in the Fall 2000 online class. Before the class began, the instructor and an investigator, in the role of Teaching Assistant, sent out a surface mail letter and an email to prospective students to provide them with general course information as well as to describe the VTB web site and how to access it.

In order to incorporate the online teambuilding module, the instructor designed an introductory unit. This unit contained the first graded assignments for the course. Assigning grades to the Teamwork Unit and online team projects provided incentives to the learners.

For the first teambuilding session, students were to meet in an online chatroom in WebCT with their instructor and the course Teaching Assistant. It was mandatory for every student to be present, but they had the option of meeting in a morning or evening session. There were no other mandatory online meetings scheduled.

Access to the course site, which contained a link to the VTB web site, was permitted a few days before class actually began. The VTB site outlined six steps that students would need to follow in order to complete the teambuilding process.

Step 1 was to fill out an electronic Pre-Course Survey form. A link was provided to the survey. The survey contained items concerning demographics, types of computer and Internet connections, student online experience levels, and experience levels of students with virtual teams.

Although students were required to participate in the Pre-Course Survey, several items on the survey were optional. At the bottom of the survey form, students were notified that information from their surveys was requested to be used in the teambuilding study. Besides investigative purposes, the information from the surveys was also used to establish heterogeneous teams. For example, to provide students with a greater chance of success when placed on teams, the investigators used the Pre-Course Survey data to optimize the placement of students onto teams in the following ways: 1) to equip the online teams with the optimum number of three people (Stadtlander, 1998), team assignments were planned that way; 2) to facilitate transferring data among team members, students were matched according to computer types, that is, PC or Macintosh; 3) to provide a range of experience levels and genders, student teams were deliberately mixed.

After completing the Pre-Course Survey, students were instructed to view the twenty-minute *PowerPoint* presentation entitled, "Recipes for Satisfying and Successful Virtual Teams," that was developed by the investigators. It was listed as Step 2 of the teambuilding process. They could view the presentation online or download it to view it from their computer desktops. At the end of the presentation, students were given an opportunity to print a copy of the presentation for future use.

In keeping with the cooking theme of the presentation, the elements of satisfying and successful teams were broken down into "ingredients." Haywood (1998), and Berry, Avergun, and Russ-Eft (1993) established "support" as the most essential ingredient for satisfying team experiences, so a checklist was developed for the instructor to go through with the class in a virtual chatroom describing how she would support the teams. This online class chat was labeled Step 3 of the teambuilding process. The checklist provided a general topic outline for the instructor to follow as she talked with the students. The instructor committed to support the teams by being available to act as an arbitrator, providing key information, and helping to guide teams toward the project goals. She also pledged to be available when called upon for assistance, but not to exert undue influence on the creativity or bonding of team members. At the end of the chat session, students were provided with a list of their teammates for the two assignments requiring teams.

Step 4 of the teambuilding process involved students making arrangements with their teammates to meet in a virtual chatroom to engage in teambuilding activities together using the worksheet as a guide. They were encouraged to do this as soon as possible because they only had one week to complete the activities. The activities were provided to the students as a printable activity worksheet available from the VTB web site. Students were directed to read through the activities before meeting with their teammates so that they would become familiar with what each of the activities involved and have some time to reflect on the questions. It was anticipated that these directions would facilitate the first online team meeting and make it as productive as possible.

Step 5 of the teambuilding process involved students posting individual results of their online team meeting including reflections, comments, and questions they had regarding the teambuilding activities and the teambuilding process in general in an online Teambuilding Forum.

Once the two required collaborative projects were completed, students were directed to go to the VTB web site to take a Post-Teamwork Survey. This was labeled Step 6 of the teambuilding process. The survey was used to explore student perceptions of their team experiences, the role of the module in their perceptions of their team experiences, the role of the module in increasing their online collaboration skills, the likelihood that they would apply the skills they learned in future online teams. Finally, at the end of the Post-Teamwork Survey, a comment section was provided. Students were urged to provide feedback about the teambuilding instruction and activities, the personal experiences they had in the assigned online teams, and their satisfaction with their team experiences.

Instruments

Three research instruments were used to gather demographic data and to measure student satisfaction levels. These included a Pre-Course Survey, Post-Teamwork Survey, and electronic postings to an online Teambuilding Forum where students discussed experiences with the online instructional module and team experiences in general. For purposes of confidentiality and analysis, the electronic postings were condensed to comments related specifically to student perceptions about the module and team experiences.

Data Gathering Process

Data generated by two online surveys, arranged chat sessions, and electronic Teambuilding Forum postings were used to obtain data relating to skills gained and satisfaction levels of students who developed online team projects. Participants released these data for the purposes of this study.

Data Analysis and Results

Four objectives were measured for this study using quantitative and qualitative data. Multiple-choice questions were used to measure quantitative data and were collected from two surveys: the pre-course survey and the post-teamwork survey. Comments from the online learners were used to provide qualitative data and were collected from chat sessions and the electronic Teambuilding Forum postings.

Survey Questions

The first objective was to explore whether or not students valued the VTB instruction they received as preparation for online team projects. Overall, responses indicated that this objective was met in terms of student satisfaction with the two components that comprised the instructional module, and student perceptions of instruction as contributing to their individual personal growth as learners and educators. Twenty-three out of the twenty-four students indicated that they valued the VTB instructional module.

The second objective was to explore how students who received specific instruction on online teambuilding perceived their actual collaborative experiences as members of a virtual team. An overwhelming majority of the student responses indicated that they were satisfied with individual team experiences encompassing elements found in successful online teams: receiving support, getting acquainted, building trust, building communication, and getting organized.

The third objective was to determine the online collaboration skills students gained after they had completed the module. Twenty-two of the students out of twenty-four acknowledged that they gained skills and knowledge essential to online collaboration.

The fourth objective was to determine whether students believed that they would use the online teamwork skills and knowledge they learned from the instructional module in future online collaborative teams. More than twenty of the students indicated that indeed they would use these skills and knowledge.

Student Comments

To substantiate some of the numerical data gathered, the investigators asked students to comment on various aspects of the module and their online team experiences. The following themes emerged from the data: *receiving support*, *getting acquainted*, *establishing communication*, *building trust*, *getting organized*, *teambuilding presentation*, *teambuilding activities*, *teambuilding module*, and *overall team experience*.

Receiving Support

There was only one comment that related specifically to student perceptions of the online support they received and it was positive: "I enjoyed this course and appreciate the hard work and dedication of the teaching assistant and the instructor."

Getting Acquainted

A total of 11 comments related specifically to student perceptions of how well their team became acquainted. Again, these comments were all positive ranging from, "[I] felt very fortunate to have two good teammates" to "**GO TEAM!**"

Establishing Communication

There were a total of nine student comments concerning communication. One student wrote, "Our backup communication plan is [first] external email and then by telephone." Other student comments were somewhat more revealing of their attitudes toward communication. For example, a student commented on the value of communication to the team, "We ended our chat by talking about the importance of keeping communication lines open by checking email daily and to call each other if necessary." Finally, since the module presented instruction on how to communicate more efficiently using acronyms and more expressively using emoticons, many students commented on how they felt about the instruction in these terms. Two typical comments included: "We introduced some clever and amusing emoticons and acronyms" and "Our 'favorite' emoticons and acronyms: ;-) LOL :o) :Q TTYL BRB :-) AKK."

Building Trust

There were a total of three comments relating specifically to perceptions of trust developed in teams and all were positive. A typical comment was, "…everyone was reliable and committed to the team."

Getting Organized

Eleven students commented on their perceptions of team organization. A few comments indicated a feeling that students were satisfied with how their team organized their work. For example, one student wrote, "We were able to work well together." The majority of the comments, however, were neutral, indicating methods of team organization only: "[We used] a sequential order and our editing path was determined," and "Whenever we get any files from any teammates, we will send a quick reply to inform of our receiving."

Teambuilding Presentation

A total of nine students commented on their perceptions of the *PowerPoint* Teambuilding Presentation. The majority of comments were positive: "All agreed that the teambuilding *PowerPoint* Presentation was well designed, had excellent tips, and would serve as a great reference for upcoming team projects." "The *PowerPoint* Presentation is a helpful guide for teambuilding. It was well organized and informative." There was one slightly negative comment, however, concerning the length of the presentation: "The presentation is pretty long, but it is really useful."

Teambuilding Activities

There were a total of 11 comments that related specifically to student perceptions of the teambuilding activities. Of all the comments made by students, this particular set of comments was the most revealing of student attitudes. The majority of comments were positive, with only one comment being neutral. Typical comments included: "I really enjoyed our teambuilding chat" and "The [teambuilding] exercises worked well to get us going."

Complete Module

There was only one student comment related to the complete module and it was positive: "The whole presentation is really easy to understand."

Overall Team Experience

Only one comment was related to student perceptions of the overall team experience and it was exceedingly positive: "The overall team experience definitely built my confidence to participate in similar activities in the future."

Discussion

From student responses relating to satisfaction with the entire module and its specific components, overall student attitudes toward the instructional module were favorable. The *PowerPoint* presentation component received a slightly better rating than the Teambuilding Activity Worksheet component.

The responses of the students relating to their individual personal growth as learners and educators demonstrated the value of the module. Overall, their opinions indicated that they felt their personal learning increased, their personal creativity increased, and their personal collaboration skills improved after receiving teambuilding instruction from the module and participating in online teams for the team projects. The comments from students describing their enthusiasm going into their teamwork included specific language and ideas taken from the teambuilding module they had just completed. For example, students commented on specific file naming systems they would use, types of editing paths they would implement, and ways they would communicate and build trust. It is evident that students had clear intentions derived from the module of what would make their online teamwork more satisfying and successful going into the team projects.

The students' satisfaction with the instruction of the online teambuilding module combined with their reports of increased learning, increased creativity, and improved collaboration skills help to strengthen the finding of Pascarella et al. (1998) that student satisfaction with instruction ultimately leads to success. Although Pascarella's study involved only face-to-face instruction, this positive relationship between student satisfaction with instruction and their subsequent success appears to apply as well in online courses using any type of instruction.

Student responses and comments on the Post-Teamwork Survey indicate that they did indeed perceive their online team experiences as satisfying and successful. The students rated their experiences according to the elements found in successful online teams: getting acquainted, receiving support, establishing communication, building trust, and getting organized. Students ranked receiving support as the most important element for their success as online team members. This finding supports the work of Berry, Avergun, and Russ-Eft (1993) and Haywood (1998) who asserted that receiving support was the major factor in team success.

Contrary to the expectations of the investigators who assumed that the module would be more rewarding to the students with less online technology experience, students with more experience seemed to value the module more than students with less experience. One possible explanation for the higher ratings of the students with more experience may be that these students felt more secure using an online instructional module and were able to glean more from it. This explanation lends further support to Sherry's (2000) finding that greater experience with technology reduces anxiety and fosters positive attitudes toward online technology.

Half of the comments from the students spoke directly to the applicability of the module indicating they valued the skills they learned enough to use them in their future roles as educators and collaborators. Additionally, the positive responses students made on the Post Teamwork survey reflected that indeed they would apply their skills towards future situations involving online collaboration. This may substantiate Rooney's (2000) conclusion that online collaboration is a skill necessary for the 21st century workplace.

Implications

The findings of this investigation have several implications: 1) the online teambuilding module used in this study does have an overall positive effect on team attitudes; 2) students who develop online collaborative projects and undergo online teambuilding instruction that includes teambuilding activities have a high satisfaction rate with their online teams; 3) students who learn online teambuilding skills do apply them to their online collaborative work; 4) students value the online teambuilding skills they learned to the extent that they indicated that they would apply to future online collaborative work; 5) instructors who assign online collaborative projects should consider incorporating teamwork instruction in their online classes; and 6) the elements found in successful teams, receiving support, getting acquainted, establishing communication, building trust, and getting organized, are also elements found in teams satisfied with their online teamwork.

Future Studies

Since a number of the students from this study wrote positive comments about their teammates and their experiences, the investigators believe that this may have implied that the manner in which teams were formed was done successfully. A study of the combination of characteristics used to form the teams could lead to interesting findings.

Additionally, as of this writing, the investigators have received a number of inquiries about the module from business entities. These inquiries warrant future research be conducted beyond the academic environment.

Finally, support plays a critical role in the success or failure of a team (Berry, Avergun, & Russ-Eft, 1993; Haywood, 1998). For this particular study, the investigators developed a checklist for the instructor that emphasized the important ways that she could offer her personal support to the online teams. In the future, however, a web-based information guide or pamphlet might be distributed to instructors describing specific ways that they can support online teamwork.

The researchers for this investigative study developed workshops to instruct faculty members at the University of Hawaii at Manoa and at Hawaii Pacific University on how they might support virtual team collaboration for their online courses. Overall, the workshops received positive feedback from the attendees. Evaluations from these workshops and others like it may also contribute to a database for further research.

VTB Web Site Access

The overwhelming positive response from students combined with the enthusiasm of educators and business professionals have led the researchers to currently work towards marketing their VTB module. However, at present, they do allow educators full access to it in return for feedback on its usefulness and suggestions for its improvement. To view a web site that provides samples taken directly from the full VTB web site, please visit: <http://members.home.net/vtbsolutions>. You may also email the researchers to request permission for access to the full VTB web site at: <vtbsolutions@hotmail.com>. Please include your name, title, institution, and how you would like to use the web site.

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THE RELATIONSHIP OF STUDENT MOTIVATION AND SELF-REGULATED LEARNING STRATEGIES TO PERFORMANCE IN AN UNDERGRADUATE COMPUTER LITERACY COURSE

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Introduction

Recent research has shown that self-regulated learning is an important aspect of student academic performance in the classroom. Self-regulated learning can be defined as a student's use of specified strategies to achieve academic goals on the basis of self-efficacy perceptions. Students practicing self-regulation behaviors initiate and direct their own efforts to acquire knowledge and skill rather than relying on teachers, parents, or others. In general, self-regulated learning consists of three essential elements: commitment to academic goals, self-efficacy perceptions, and self-regulated learning strategies (Zimmerman, 1989).

Student academic goals are the underlying reasons or purposes for the students' learning behaviors. They represent the meaning that students assign to achievement situations. These goals provide a sort of cognitive organizational structure that encompasses how students define their successes and failures, affective reactions, and future behaviors (Urdan, 1997). Researchers on achievement motivation have found that different types of goal orientations elicit different motivational processes (Ames & Archer, 1988).

Academic goals are most often described as either mastery or performance goals. Students possessing mastery goals are considered to be intrinsically motivated, primarily focusing on learning or mastering the course material. Because they value the learning process itself, these students often seek out challenging assignments and put forth more effort to learn the material. They also tend to use more effective learning strategies while studying. In contrast, students with performance goals are considered to be extrinsically motivated. These students tend to focus on the outcome of their learning and are primarily interested in earning a good grade in the course, or gaining social esteem (Dweck, 1986; Pintrich 1995). Since they are mostly concerned with the reward that comes after they have learned the material, they tend to use less effective learning strategies. For students with performance goals, learning the material is often seen as a means to an end rather than an end in itself.

Although student goals provide direction and incentive for academic work, a second self-regulation element affecting student achievement is the students' beliefs about his or her ability. Belief in ones' ability to successfully perform a particular task is known as self-efficacy. Bandura (1986) stated that self-efficacy beliefs influence an individual's willingness to attempt a particular task, the level of effort he or she will employ, and his or her persistence in accomplishing the task. Self-efficacy is particularly important because of its two-fold effect on the other components of self-regulation. Not only does self-efficacy influence the type of goals students set for themselves but it also affects the amount of effort they invest in working toward these goals (Pintrich, 1995).

Previous research on self-efficacy has indicated that student behaviors can often be better predicted by their beliefs about their capabilities than by what they are actually capable of accomplishing. Results have shown that people's beliefs help determine what they do with the knowledge and skills that they have (Pajares & Miller, 1994). Typically, students with high-self efficacy are confident in their skills and abilities to do well and have been shown to participate more in learning activities, show greater effort and persistence, and achieve higher levels of academic performance than students with low self-efficacy (Pintrich & De Groot, 1990; Schunk, 1991). Even when experiencing difficulty, students with high self-efficacy tend to work longer and harder than do students with low self-efficacy. On the other hand, students with low self-efficacy frequently show less persistence and may attempt to avoid the learning situation altogether (Hagen & Weinstein, 1995). Lack of self-efficacy has also been coupled with the debilitating affect of high test-anxiety (Bandura, 1986).

A third element of self-regulation consists of student's learning strategies. Self-regulated learning strategies are the behaviors and actions students use to acquire desired information or skills. They include such methods as organizing and applying new information, self-monitoring one's performance, seeking assistance, and managing time and study environments (Pintrich, Smith, Garcia & McKeachie, 1991; Zimmerman, 1989; Zimmerman & Martinez-Pons, 1986). Students' use of self-regulated learning strategies depends not only on their knowledge of strategies but also on their academic goals and self-efficacy perceptions. Students with learning goals tend to use deep processing strategies that enhance their understanding of concepts. They attempt to integrate information and monitor their comprehension (Pintrich & Garcia, 1991). Conversely, students with performance goals, tend to use strategies that promote only short-term and surface level processing, like memorizing and rehearsing (Graham & Golan, 1991).

In much of the previous research on self-regulated learning, the focus has been on determining the foundational elements of the construct and the relationship between these elements. The results of this work have indicated that self-regulatory processes are linked with content domains, and individuals learn how to apply these skills in a given learning or applied context

(Zimmerman, 1998). Determining the specific self-regulatory processes associated with successful learning in particular content domains is an important next step in this line of research.

Computer Literacy courses are offered by many colleges and universities and are often taken by students from various academic majors. For many students, this course is a requirement of their degree programs. For others, the importance and applicability of the content information are influential factors in their desire to take the course. Very often, student enrollment in these courses may be as high as two- to three-hundred students per semester. Because Computer Literacy courses are so prevalent and the content a necessity to many college students, it is important to determine the relationship of motivation and learning strategies affecting learning and performance in these courses. It is also important to discover the various approaches and methodologies undergraduate students report they use to learn the course material.

The purpose of this study was to determine the relationship among students' reports about their goal orientation, self-efficacy and self-regulated strategy use and their academic performance in a Computer Literacy course as indicated by course grade. We also investigated students' reports about their most preferred and utilized study techniques and the techniques they used to monitor their learning in this course.

Method

Subjects

All participants in this study were students in a general studies Computer Literacy course at a large university in the southwest. Of the 291 participants, 193 were female and 98 male. The majority of the participants were education (27%), communication (18%), or broadcasting (11%) majors. In total, 26 different academic majors were represented. Four percent were freshman, 27% sophomores, 47% juniors, 21% seniors, and 1% graduate students. Students ranged in age from 18 years to 50 years, with an overall average age of 22.

Procedures

The Computer Literacy course was a multi-section course consisting of a lecture class and lab. The lecture portion of the course met in a large lecture hall twice a week for 50 minutes, while the lab section met in a PC computer lab once a week for a period of one hour and 50 minutes. In total, there were 17 lab sections for this course. Data were collected at the end of the fall 2000 semester during lab sections in which students were completing their semester final exam. In each lab section, the investigator described the survey, "Strategies Used for Learning in a Computer Literacy Course". Students completed the survey after finishing their final exam. Participation in the study was voluntary. Students were given two extra credit points toward their course grade for completing the survey.

Materials

The participants completed the survey "Strategies Used for Learning in a Computer Literacy Course". This survey consisted of three sections. The first section included demographic questions as well as selected response questions regarding the lowest grade they would be happy with in this course, and how many hours a week they study for this course. Participants were also asked to respond to a series of yes or no questions aimed at discovering their reasons for taking this course. Examples of these questions were, "The course is required for my major", "The content seems interesting", "It is an easy elective", and "It will improve my career prospects".

The second section of the survey included 73 motivation and learning strategies questions adopted from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et.al., 1991). The MSLQ is a self-report instrument designed to assess college students' motivational orientations and their use of different learning strategies. The motivation section of the MSLQ consists of six sub-scales with items designed to assess students' goals and value beliefs for a course, their beliefs about their skills to succeed in a course, and their anxiety about tests in a course. The learning strategy section consists of nine sub-scales with items regarding students' use of different cognitive and metacognitive strategies as well as management of various resources. Students rate themselves on a 7-point Likert scale (1 = not true of me, to 7 = very true of me).

The various sub-scales on the MSLQ can be used together or separately. Two learning strategy sub-scales, Rehearsal, and Help Seeking, were not used in this study due to the lower Cronbach alpha scores published by Pintrich et.al. (1991) for these scales (.69, and .52 respectively).

The third section of the survey consisted of eight questions, two selected-response and six open-ended, focusing on student study habits. The selected-response questions asked students if they study differently for this class than for their other classes and who is responsible for their success in learning, themselves or their instructor. The open-ended questions asked participants to describe two ways that they study for this class, two ways that they study for their other classes, how they check their understanding of the material while studying for this course, what is their major strength as a learner, what is their major weakness as a learner, and what they think would help them become better learners.

Data Analysis

Using the method developed by Pintrich et.al. (1991), the MSLQ sub-scale scores for each participant were constructed by taking the mean of the items that make up that scale. For example, intrinsic goal orientation has four items. An individual's score for intrinsic goal orientation was computed by summing the four items in the sub-scale and taking the average. There are some negatively worded items and the ratings were reversed before an individual's score was computed. The statistics reported represent the positive wording of all the items. In general, a higher score of 4, 5, 6, or 7 for a sub-scale mean score indicates that the student feels the items were a fairly good representation of their motivational orientation or learning strategies used in this course.

Multiple regression analysis for two unordered sets of predictors was used to evaluate how well the use of specific motivation and learning strategies predicted course grade. The Holms Method was used to control for Type I error.

The responses to each open-ended question were analyzed and categorized by discernable themes. The number of responses in each thematic category was then calculated. Responses to the selected-response questions were compiled and summarized by frequency of occurrence.

Results

Three sets of analyses were conducted and results are organized accordingly. The first set consisted of multiple regression analyses examining the MSLQ responses and their relationship to course grade. In the second set of analyses, frequencies of responses and the thematic categories to the eight study-habit questions were determined. In the last set of analyses, the students' answers to the selected-response general course questions were analyzed and summarized.

Results from MSLQ Assessment of Student Motivational Orientations and Learning Strategies

Table 1 displays the means and standard deviations for course grade and scores on the MSLQ sub-scales. Significant sub-scale mean scores will be discussed along with mean scores for individual items on these sub-scales.

Table 1 Mean Scores and Standard Deviations on Course Grade and MSLQ Sub-scale Summaries

Variables		Mean	Standard Deviation
Course Grade		2.73	.98
Motivation Scales	Intrinsic Goal Orientation	4.62	1.10
	Extrinsic Goal Orientation	5.00	1.23
	Task Value	5.10	1.18
	Control of Learning Beliefs	5.18	1.06
	Self-Efficacy for Learning and Performance	5.32	1.07
	Test Anxiety	3.87	1.46
Learning Strategy Scales	Elaboration	4.21	1.16
	Organization	3.71	1.33
	Critical Thinking	3.49	1.24
	Metacognition	4.01	.94
	Time and Study Environment Management	4.31	1.10
	Effort Regulation	4.25	.85
	Peer Learning	3.06	1.52

Note: Sub-scale mean scores can range from 1 to 7.

The possible mean scores for the MSLQ sub-scales can range from one to seven. The selection of a one for an item on a sub-scale indicated that the student believed the item was not at all true of them, whereas a selection of seven indicated that the student believed the item was very true of them. The scores for all the individual items on the sub-scale were then averaged together to determine the mean score for the sub-scale.

The range of final course grades was from A through E. The numeric value associated with each grade was A = 4, B = 3, C = 2, D = 1, E = 0. Final course grades resulted in the following distribution: A= 65 (22%), B = 120 (42%), C = 75 (26%), D = 24 (8%), and E = 7 (2%).

Motivation Sub-scale Results

In response to the sub-scale items on the motivation scale, participants rated extrinsic goal orientation and self-efficacy fairly high, as indicated by the Extrinsic Goal Orientation and Self-Efficacy for Learning and Performance sub-scale mean scores. The mean score for the Extrinsic Goal Orientation sub-scale was 5.0 and Self-Efficacy for Learning and Performance was 5.3. Additionally, participants appear to not worry about course tests as indicated by a mean score of 3.8 on the Test Anxiety sub-scale.

Extrinsic goal orientation sub-scale results.

There were four items on the Extrinsic Goal Orientation sub-scale, with three items focusing on the importance of course grades and one item focusing on the approval of others. Mean response scores for each of the three items asking students to rate the importance of earning high course grades were fairly high, with each item mean score over 5.0. These items asked students to rate their satisfaction, value, and desire to earn a grade higher grade than their classmates. Based on the mean scores for each item, it appears that earning a good grade was a goal of many students.

The one item on the sub-scale focusing on the importance of earning a good grade in order to receive approval from others had a mean score of 4.3. The mean score is approximately at the midpoint of the scale range, indicating that for some students, earning a good grade was important in order to prove their ability to others.

Self-efficacy for learning and performance sub-scale results.

There were eight items on the Self-efficacy for Learning and Performance sub-scale, with five items focusing on the students' judgment about his or her ability to accomplish the tasks for the course, and three items focusing on the students' expectation for success in the course.

Mean response scores for the five items focusing on the students' beliefs about being able to accomplish the tasks for the course were positive and ranged from 4.7 to 6.1 on the seven-point scale. These items asked students to rate their beliefs in their ability to understand both basic and complex course material, and their confidence in performing well on course assignments and tests.

Mean response scores for each of the three items focusing on the students' expectancy for success were also very positive and ranged from 5.1 to 5.6. These items asked students to rate their beliefs on being able to earn an excellent grade, and their beliefs in their overall ability to do well in the course.

Test anxiety sub-scale results.

There were five items on the Test Anxiety sub-scale, with three items focusing on worry or negative thoughts during test taking and two items focusing on physiological arousal aspects of anxiety, such as upset feelings, and rapid heart beat

The mean response scores for the three items focusing on worry were approximately at the mid-point of the seven point scale, ranging from 3.2 to 4.2. These mean scores seem to indicate that for most students, they were not worrying about the possibility of a poor performance or even failure during test taking.

The mean response scores for the items focusing on the physiological aspects of anxiety were 3.6 and 4.2. These mid-range mean scores indicated that most students were not upset or did not have uneasy feelings during test taking.

Learning Strategy Scale Results

In response to the learning strategy items, participants rated elaboration fairly high and peer learning fairly low as indicated by the Elaboration and Peer Learning sub-scale mean scores. The mean score for the Elaboration sub-scale was 4.21 and Peer Learning was 3.06.

Elaboration sub-scale results.

There were six items on the Elaboration scale all focusing on study techniques that help students integrate and connect new information with prior knowledge. Mean response scores for these items ranged from a low mean score of 3.0 to a fairly high mean score of 5.0.

The mean response score for the item asking students whether they write brief summaries of course readings had a low score of 3.0, indicating that most students did not use this study technique. The remaining items on this sub-scale asked students if they try to connect the information learned in this course to prior knowledge or to other courses had higher scores of 4.2 to 5.0, indicating that many students used these methodologies when studying.

Peer learning sub-scale results.

There were three items on the Peer Learning scale all focusing on whether students worked with classmates to complete assignments or enhance their understanding of course content. Mean response scores for all three items were fairly low on the seven-point scale, ranging from 3.3 to 3.8. These low scores seem to indicate that students did not prefer to work with classmates in order to learn the course material.

Analyses to Determine Relationship Among Motivational Orientations, Learning Strategies, and Course Grade

Two multiple regression analyses were conducted to predict final course grade from students' self-reported motivation and use of learning strategies. One analysis included the six motivation strategies as predictors (intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy and test anxiety), while the second analysis included the seven learning strategies predictors (elaboration, organization, critical thinking, metacognition, environment regulation, effort regulation, and peer learning). For both analyses, the Holms Method was used to correct for Type I error. These two sets of predictors are unordered. The regression equation with the motivation strategies was significant, $R^2 = .14$, adjusted $R^2 = .12$, F (6, 284) = 7.70, $p < .001$. The regression equation with the learning strategies was also significant, $R^2 = .13$, adjusted $R^2 = .11$, F (7, 283) = 6.27, $p < .001$.

Indices indicating the relative strength of the individual predictors are presented in Table 2. Of the motivation components, extrinsic goal and self-efficacy were positively related to course grade, while test anxiety was negatively related to course grade. Of the learning strategies, elaboration was positively related to course grade and peer learning was negatively related to course grade.

Table 2 The Bivariate and Partial Correlations of the Predictors with Course Grade

Predictors		Correlation between each predictor and course grade	Correlation between each predictor and course grade controlling for all other predictors
Motivation Scales	Intrinsic Goal Orientation	.12	-.03
	Extrinsic Goal Orientation	.22 ***	.19
	Task Value	.09	-.05
	Control of Learning Beliefs	.09	-.04
	Self-Efficacy for Learning and Performance	.30 **	.17
	Test Anxiety	-.18 *	-.16
Learning Strategy Scales	Elaboration	.13 ***	.16
	Organization	.04	-.04
	Critical Thinking	-.07	-.15
	Metacognition	.11	.08
	Time and Study Environment Management	.22	.14
	Effort Regulation	-.03	.02
	Peer Learning	-.19****	-.21

* p <.0125, ** p<.01, *** p<.008, **** p<.007

Next, in order to determine moderating effects of one significant variable on another significant variable, we created five interaction terms. Development of the interaction term was based on both the statistical significance of each variable and conceptual importance. The five interaction terms were created by developing cross-products of the following variable combinations: self-efficacy and peer learning, extrinsic goal and peer learning, extrinsic goal and self-efficacy, extrinsic goal and test anxiety, self-efficacy and test anxiety. Of the five interaction terms, only two were significant.

The first interaction term created by the cross product of self-efficacy and peer learning was significantly related to course grade, F (3, 287) = 14.09, $p < .001$. Students who had high self-efficacy who collaborated with their peers were likely to have lower grades. In contrast, students with low self-efficacy who collaborated with peers were more likely to have higher grades.

The second interaction term created by the cross product of extrinsic goal and peer learning was also significantly related to course grade, F (3,287) = 11.27, $p < .001$. Students with high extrinsic goal orientation who collaborated with their peers were likely to have lower grades. In contrast, students with low extrinsic goal orientation who collaborated with their peers were likely to have higher grades.

Responses to Questions About Students' Study Habits

In addition to responding to the MSLQ items, students were also asked to respond to two selected-response questions and six open-ended questions focusing on their study habits. Their responses were analyzed by frequency of occurrence. Not all participants answered all of the questions in this section, possibly due to time constraints or simply lack of interest in responding. Because of this, the total number of responses for each question may not equal the total number of participants. Summaries of the responses are provided in Table 3. The responses for each question are listed in rank order of occurrence, beginning with the highest-ranking response. The numbers provided indicate the total responses. The percentages are based on the total number of responses for the particular question. Results of the analyses on the two-selected response questions will be presented first, and will then be followed by the results of the analyses on the six open-ended questions.

Table 3 Summary of Responses to Study Habit Questions

Do you study different-ly for this class than most of your other classes? (150)	As a student, who do you think is respon-sible for your success in learning? (150)	What methods do you use to study for this course? (222)	What methods do you use to study for your other courses? (200)	How do you check your under-standing of course material? (105)	What is your major strength as a learner? (108)	What is your major weakness as a learner? (77)	What would help you become a better learner? (97)
No 78 (52%)	I am 119 (79%)	Read text and notes 106 (48%)	Read text and notes 115 (57%)	Apply information 32 (30%)	Ability to memorize 26 (24%)	Procras-tinate, unmoti-vated, lazy 33 (43%)	Study schedule 23 (24%)
Yes 72 (48%)	My instructor 12 (8%)	Apply informa-tion 51 (23%)	Outline readings 31 (16%)	Quiz myself 29 (28%)	Visual learner 22 (20%)	Low attention span 28 (36%)	Disci-pline 23 (24%)
	Both 19 (13%)	Use course study guide 31 (10%)	Study with peers 21 (10%)	I don't 16 (15%)	Ability to compre-hend and under-stand 19 (18%)	Lack of time 10 (13%)	Hands-on, real world applica-tions 17 (18%)
		Use flashcards 17 (7%)	Use flashcards 20 (10%)	Make sure it is memo-rized 10 (10%)	Hands-on learner 18 (17%)	Not good in lectures 6 (8%)	More time 14 (14%)
		Study with peers 9 (4%)	Memo-rize material 9 (5%)	Discuss-ions with Teaching Assistants 10 (10%)	Persis-tence and dedica-tion 13 (12%)		Better study skills 11 (11%)
		Highlight text 8 (4%)	Attend class 4 (2%)	Discuss-ions with peers 8 (7%)	Quick learner 10 (9%)		Read more 9 (9%)

Note: Number of responses varies between questions because some participants did not provide responses while others provided multiple responses. Percentages based on total number of responses for each question.

Selected-response Question Results

The first selected-response question asked students if they studied differently for this Computer Literacy course than for their other courses. Students were to respond by circling either "Yes" or "No". Of the 150 participants responding to this question, 78, or 52%, circled "Yes", indicating that they studied differently, and seventy-two, or 48% circled "No", indicating that they studied the same way.

The second question asked students who they thought has responsibility for their success in learning. Students were to respond by circling "I am" or "My instructor is". Again, 150 students responded. The vast majority of the students, 119 or 79%, circled "I am" indicating that they are responsible. A small group of students, 12 or 8%, circled "My instructor" indicating that they feel the instructor is responsible for their success in learning, and 19, or13%, wrote in that both they and the instructor are responsible for their success in learning.

Open-ended Question Results

The first open-ended item in this section asked students to list two ways that they studied for the Computer Literacy course. Reading the text and notes was the most frequently-listed study technique, with 106 responses or 48%, followed by applying information learned in lecture to the lab class, with 51 responses, or 23%. Studying with peers was listed only 9 times, or 4%.

The second open-ended question asked students to list two ways that they studied for their other courses. Again, the most frequently-listed study technique mentioned by students was reading the text and notes, with 115 responses, or 56%. The next most frequently occurring response was outlining readings, listed 31 times, or 15%. Studying with peers was listed 21 times, accounting for 10% of the responses.

The third open-ended question asked students to describe how they check their understanding of the Computer Literacy course material. The responses to this question indicated that there were two methods that most students used to check their understanding. Thirty-two students, or 30%, indicated that applying the lecture information by working on the computer helped them to determine their understanding of the material, 29 students, or 28%, stated that they quizzed themselves, and 16, or 15%, stated that they didn't check their understanding.

The fourth open-ended question asked students what they considered to be their strength as a learner. These results were mixed, with three characteristics being mentioned most often. In total, 108 students responded, with 26 participants, or 24%, indicated their ability to memorize was their strength. Twenty-two students, or 20%, stated that their strength was based on the fact that they were visual learners, and 19 students, or 18%, cited their ability to comprehend and understand.

The fifth open-question asked students what they considered to be their weakness as a learner. Most responses centered around two main themes, procrastination and low attention span. Of the seventy-seven students who responded to this question, 33 students, or 43%, indicating that procrastination, lack of motivation and laziness was their weakness, and 28, or 36% of students indicated that their weakness was due to their low attention span. Ten students, or 13%, indicated that they didn't have enough time to dedicate toward studying.

The final open-ended question asked participants what they thought would help them to become a better learner. From the responses, it appears that there are four factors students felt could possibly influence their learning. Of the 97 students that responded, 23, or 24%, indicated a study schedule would be helpful, and 23 indicated that they needed to be more disciplined. Seventeen students, or 18%, stated that they needed more hands-on, real world applications, and 14 students, or 14%, needed more time in their daily lives to dedicate toward school.

Responses to General Course Questions

Participants were also asked to respond to a series of selected response questions regarding the lowest grade they would be happy with, and how many hours a week they study for this course. They were also asked to respond yes or no to a series of nine items aimed at discovering their reasons for taking this course.

Lowest grade acceptable

Participants were asked to indicate the lowest course grade that would be acceptable to them, A, B, C, D, or E. For each participant, the actual grade earned was then compared to the lowest grade acceptable. Summary of the responses and the comparison between the lowest grade acceptable and actual grade earned are provided in Table 4.

Table 4 Comparison of Lowest Grade Acceptable to Actual Grade Earned

Lowest Grade Acceptable	Participants Indicating This as Lowest Grade Acceptable	Actual Grade Earned by Participants				
		A	B	C	D	E
A	78 (27%)	46 (59%)	23 (29%)	7 (9%)	2 (3%)	-
B	161 (55%)	17 (11%)	85 (53%)	43 (27%)	14 (8%)	2 (1%)
C	51 (18%)	2 (4%)	11 (21%)	25 (49%)	8 (16%)	5 (10%)

N = 290.

All participants wanted to earn a grade higher than C. In total, 156 students, or 54%, earned the grade they indicated would be the lowest grade acceptable, 104 students, or 36%, earned a grade lower than that which was acceptable, and 30 students, or 10%, earned a grade higher than their lowest grade acceptable.

Number of weekly study hours

Participants were also asked how many hours a week they study for this course. They were given five possible choices to select from; 0 hours, 1-3 hours, 4-6 hours, 7-8 hours, and more than 9 hours. Response totals and percentages are provided in Table 5.

Table 5 Reported Number of Study Hours per Week Dedicated to the Computer Literacy Course

Hours per week	Total Responses
0	40 (14%)
1 - 3	206 (71%)
4 - 6	37 (13%)
7-8	5 (2%)
9 or more	2 (1%)

N = 290

In general, 206 students, or 71%, indicated that they dedicated between one to three hours per week studying for this course and 37 students, or 13%, indicated that they dedicated four to six hours per week studying for this course. Forty students, or 14%, responded that they did not study at all for this course.

Reasons for enrolling the Computer Literacy course

The last question in this section of the survey asked students about the reasons they had for taking this course. They were asked to respond yes or no to a series of nine items aimed at discovering their purpose. They were to indicate all reasons that were applicable to them. Response totals and percentages are shown in Table 6.

Table 6 Reasons Students Enrolled in the Computer Literacy Course

Reason	Total Responses
Will be useful to me in other courses	248 (85%)
Required for academic major	233 (80%)
Will improve my academic skills	211 (73%)
Fit into my schedule	212 (73%)
Will improve my career prospects	205 (70%)
Content seems interesting	191 (66%)
Was recommended by my advisor	170 (58%)
Is an easy elective	106 (36%)
Was recommended by a friend	71 (24%)

The responses indicated that most students, 248 or 85%, thought this course would be helpful to them in other courses, and for 233 students, or 80%, this course was a requirement of their academic major. Many students, 211, or 73%, felt the course would improve their academic skills and 205 students, or 70%, felt the course would improve their career prospects. One-hundred ninety-one students, or 66%, took the course because they thought the content seemed interesting.

Discussion

The purpose of this study was to determine the relationship among student self-reports of their academic goal orientation, self-efficacy, self-regulated learning strategy use and their academic performance in a Computer Literacy course as indicated by course grade. Also investigated were students' most preferred and utilized study techniques and the methods they used to monitor their learning in this course.

The results of this study portray a complex combination of the motivation, and learning strategies utilized by college students in a Computer Literacy course. Overall, the results appear to indicate that these students held both extrinsic and intrinsic goal orientations at the same time. For many students, earning a high grade was very important to them, and many took the course because they thought the content would be valuable and interesting. These students also reported that they have both high self-efficacy and low test-anxiety, they utilize elaboration learning strategies and prefer to not study with their peers. Approximately half of the students earned the grade that they indicated was the lowest grade acceptable to them, but about one-third of the students earned a poorer grade than the lowest grade acceptable to them. The majority of students reported that they spent between one and three hours per week studying for this course, however, many indicated that more discipline and a study schedule would help them become better learners

In terms of achievement goals, findings in this study indicated that extrinsic goal orientation was positively related to course grade. This finding is similar to results from a previous study focusing on college students' goal orientations and use of self-regulation strategies in the classroom. In their study, Pintrich & Garcia (1991) found that having an extrinsic goal orientation, such as a commitment to earning high grades, may actually help students focus not only on learning the course material, but also may assist them in maintaining their self-efficacy.

In the current study, self-efficacy was also positively related to course grade. From this finding, it appears that students had a combination of extrinsic goal orientation and high self-efficacy, which may have caused them to persist in their learning of the course material to achieve their desired academic goal. When individuals with either extrinsic or intrinsic goal orientation have high self-efficacy beliefs their behavior is quite similar (Miller, Behrens, Greene, & Newman, 1993). Individuals with high self-efficacy are confident in their ability to succeed at a task, tend to accept the challenge of the task and will persevere in an effort to successfully complete it.

Self-efficacy beliefs also influence the amount of stress and anxiety individuals experience as they engage in a task and the level of accomplishment they realize. In the current study, students reported high self-efficacy beliefs, therefore, it is not surprising that they also indicated they had low-test anxiety. Individuals with a strong sense of competence approach difficult tasks as challenges to be mastered rather than dangers to be avoided. Conversely, individuals with low self-efficacy beliefs may feel that things are tougher than they really are, a belief that fosters stress, depression and a narrow vision of how to solve a problem (Pajares, 1997).

Student selection of learning strategies used to accomplish a task is also dependent on both beliefs of goal orientation and self-efficacy. Results from previous studies have indicated that extrinsically motivated students tend to use short-term and surface-level processing strategies, such as memorizing and rehearsing strategies (Miller, et. al., 1993). Additionally, individuals with performance goals are less concerned with learning, and the use of learning strategies requires effort which implies a lack of ability, an inference that performance oriented students do not wish to make (Ames & Archer, 1988).

In the current study, the learning strategy of elaboration was positively related to course grade. Elaboration learning strategies are generally considered to be utilized by students with intrinsic goal orientations. For students that are intrinsically motivated, their goal is to learn the course material, therefore, learning strategies such as elaboration are often used to enable them to make new information more meaningful by connecting it with prior knowledge (Weinstein & Mayer, 1986). However, results from research by Pintrich and Garcia (1991) found that students with either intrinsic or extrinsic goal orientations both reported substantial use of cognitive and self-regulated learning strategies, such as elaboration and organization. It appears that a high level of concern for grades may actually lead to better cognitive engagement.

From earlier motivational research, it was generally believed that students have either a mastery or performance goal (Meece & Holt, 1993). Yet recent research on the relationship between mastery and performance goals has indicated that these two types of goals are independent of one another rather than opposite of one another. This independence means that it is possible, and perhaps even likely, for students to have both mastery and performance goals at the same time (Pintrich & Garcia, 1991).

Interestingly, results of the current study also indicated that students valued the information they were learning in the Computer Literacy course. Though intrinsic goal orientation was not significantly related to course grade, student responses to the items focusing on their reasons for taking the course indicated that a majority of students enrolled because they thought the course material was interesting. Students that enroll in courses because they find the content interesting or enjoyable are intrinsically motivated. They are taking the course for its inherent satisfaction rather than because it may lead to a separable outcome (Ryan & Deci, 2000). Based on these findings it appears the students in the Computer Literacy course had a combination of intrinsic and extrinsic goal orientations.

Though results of the current study appear to be consistent with the finding of Pintrich & Garcia (1991), it is also important to consider the course context in which the learning strategies were being used. In their responses on the Elaboration sub-scale items on the MSLQ portion of the survey, students in the current study indicated that they used information from lectures and readings to accomplish learning tasks and activities. The Computer Literacy course was comprised of a lecture and lab session, therefore, it is not surprising that students would use information learned in lecture to accomplish lab activities. These results seem to suggest that good strategy use in the classroom may be conditional and contextual to the learning situation, and may not be solely dependent on student goal orientation and self-efficacy beliefs. Future research may be necessary to further clarify these results.

Another characteristic of extrinsically motivated students is their desire to demonstrate their ability, or hide their perceived lack of ability. The fear of appearing incompetent can cause students to use behaviors that they feel might protect their sense of self-worth (Archer, 1994). Results of the current study indicated that peer learning was negatively related to course grade. This result is not surprising since students held high extrinsic goal orientations. A characteristic of many extrinsically motivated students is demonstrating competence to others. Because of this, perhaps these students did not want to appear incapable in front of others. When students pursue goals that concern maintaining a certain image in front of others, they interpret the need for help as a threat to self-worth. (Archer, 1994).

An interesting finding from the current study indicated that students with low self-efficacy beliefs that studied with classmates were likely to have higher grades. Comparatively, students with high self-efficacy that studied with classmates were likely to have lower grades. These results appear to be in contrast to previous research focusing on the effects of goal orientation and help seeking. Results from previous studies, found that students who had low self-efficacy beliefs were more likely to feel threatened when asking their peers for help and were more likely to avoid those types of activities. These students feel that their need for help indicates that they lack ability, therefore, they are less likely to seek assistance (Ryan & Pintrich ,1997; Ryan, Gheen, & Midgley, 1998).

Another interesting finding of the present study also indicated that students with high extrinsic goal orientation that studied with their classmates were likely to earn lower grades. Those students with low extrinsic goal orientation that studied with their classmates were likely to earn higher grades.

Also investigated in this study were the reported study techniques utilized by students in the Computer Literacy course, and what they felt would help them become more successful in their learning. It is interesting to find that approximately half of the students in this study indicated that they study the same way for this course as they do their other courses, and half stated that they study differently. The majority of students indicated that the study strategies they used in the Computer Literacy course were reading their textbook and lecture notes, then applying that information to computer activities. Most students also monitored their understanding of course material while trying to apply this information to the computer activities.

Results from previous research have indicated that use of various learning strategies may be conditional and contextualized. Students, therefore, need to understand the situations when certain learning strategies may be more or less effective (Pintrich & Garcia, 1994). When encountering a learning situation for the first time, students may not know how to think within that discipline. Pintrich (1995) suggests that in order for students to become successful self-regulated learners, teachers should help students become aware of how to think, learn, and reason within the particular discipline. Perhaps this would be beneficial for students in the Computer Literacy courses.

For many students in this course, it appears that learning techniques may need to be improved in order to promote more successful learning. There may possibly be variations to study strategies that could enhance learning in these types of courses. The majority of students indicated that they felt responsible for their success in learning, however, only half of them earned the grade that was the lowest grade acceptable to them, with many others earning a poorer grade. Students also indicated that they believed they could be more successful if they had a study schedule and more discipline. It may be beneficial, therefore, to provide students with appropriate strategies for learning the course material and assisting them in establishing suitable study schedules.

The results of this study highlight the motivation and learning strategies most related to course grade in a Computer Literacy course. This study not only provides information on students' learning goals and their use of self-regulated learning strategies, but it also gives insight to how undergraduate students view learning and the methodologies they use to study. The information provided from this study may assist teachers of undergraduate students in Computer Literacy courses, as well as other computer based courses.

Results of this investigation suggest several avenues for future research. First, measurements in the current study were gathered at only one point in time. It may be useful to replicate this study on a longitudinal basis to further examine the relationships between the motivation and learning strategies that prove to be most effective. Second, it would also be beneficial to look further into the interactions of the significant variables to determine the interplay and influence they may have on student learning and performance. Third, in this study, student self-report measures were used. It would be informative to use other data gathering measures such as interviews and observations. Finally, additional research may be needed to determine how classroom context and structures impact the motivational and learning strategies used by students.

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The Impact of Hypermedia Instructional Materials on Study Self-Regulation in College Students

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Abstract

Does the introduction of hypertext and hypermedia into college instruction impact students' ability to regulate their own learning processes? The metacognition "calibration of comprehension" research paradigm is used to investigate this question. Interviews with experimental subjects provide additional insights into the study process.

Introduction

To be academically successful, college students must effectively allocate study effort among multiple courses based on the requirements of each course. An important study self-regulation skill is the ability to answer the pragmatic question "Do I know this subject matter well enough to take the test?" College students have developed this skill – to varying degrees – through years of studying paper-based textbooks. In today's college environment, Web and CD-ROM instructional materials require students to study materials displayed on a computer screen and organized in a nonlinear structure. Do these nonlinear hypertext and hypermedia instructional materials impact students' ability to accurately assess their own test readiness and thus to effectively regulate their study processes? If so, then the promotion of hypermedia instructional materials in the college environment may create unintended stumbling blocks to academic success.

Literature Review

The research literature to date does not address this issue. Although numerous studies have examined the use of hypertext and hypermedia as instructional media, there is no body of literature addressing impacts of hypermedia on self-regulation of the learning process. Some studies do, however, suggest there may be cause for concern.

Conklin (1987) noted two fundamental issues with hypermedia: disorientation and cognitive overhead. Hypermedia reading requires much greater mental effort in managing the reading process (compared to the simple page-turning of print environments); this mental activity can divert mental resources from the intellectual activity of reading and learning (Dede & Palumbo, 1991). Hypermedia users may lack the navigational skills needed to be successful in hypertext-based learning (Lawless & Kulikowich, 1996; Schroeder & Grabowski, 1995). Domain knowledge of the individual reader is a key determinant of a reader's ability to successful learning in the hypertext environment (Beishuizen et al., 1994; Lawless & Kulikowich, 1996). Reading text from the computer screen generally requires more time (Belmore, 1985; Gould, Alfaro, Finn, Haupt, & Minuto, 1987; Grice, Ridgeway, & See, 1991; Kearsley, 1988). Some experiments have found poorer comprehension with computer-based text (Belmore, 1985; Feldmann & Fish, 1988; Fish & Feldmann, 1987; Reinking & Schreiner, 1985).

Although silent on the question of hypermedia impacts, reading and cognition researchers have investigated learning self-regulation. During the past 15 years, a number of research studies have explored learning self-regulation using a research paradigm known as "calibration of comprehension" (Lin & Zabrucky, 1998). In the current research, the calibration of comprehension paradigm has been adapted to investigate study self-regulation in a hypermedia learning environment.

In a typical calibration experiment, subjects read expository text and then are asked to predict their performance on a simple objective test over the materials read. Actual test performance is compared to self-assessed predicted performance using a correlation coefficient. Subjects able to accurately predict their performance are considered "highly calibrated" regardless of their performance on the test. Likewise, subjects who do not predict their performance accurately are considered "poorly calibrated."

Calibration of comprehension research has shown correlation between predicted performance and actual performance ranging from virtually zero to greater than $\underline{r} = .60$ (Lin & Zabrucky, 1998). Calibration research has also identified several ways in which research designs can maximize the probability of detecting calibration if it is indeed taking place. These guidelines were followed in the current research project:

1. Since posttest performance predictions may be influenced by subjects' prior knowledge of the topic (Glenberg & Epstein, 1987) and by subjects' interest in the topic (Glenberg et al., 1982; Lin et al., 1997), some method of assessing these subject attributes may be useful in the study.
2. Text should be of moderate difficulty for the research subject population (Weaver & Bryant, 1995; Weaver et al., 1995).
3. Posttests should have more than one question per text segment. Weaver (1990) found four questions per text to produce significantly more accurate indications of calibration than a single question per text.
4. Since subjects are better able to inventory their understanding and retention of facts than they are their ability to recognize logical inferences, posttest questions should deal with the recognition of facts and ideas (Glenberg et al., 1987; Pressley et al., 1987).

Experiment

Presentation technology (paper or computer) and content structure (linear or nonlinear) were independent variables in this 2x2 factorial design quantitative study. As illustrated in Figure 1, instructional materials were differentially formatted to create the four experimental treatments. Content was identical in each treatment and consisted of eight topics. The instructional materials (and corresponding test questions) were adapted from a well-established curriculum and test bank.

		Presentation Technology	
		Paper (P)	**Computer (C)**
Content Structure	**Nonlinear (N)**	**NP Environment** Nonlinear text in paper form (printed nonlinear WWW site).	**NC Environment** Nonlinear text on computer (hypermedia).
	Linear (L)	**LP Environment** Linear text in paper form (book).	**LC Environment** Linear text on computer.

Figure 1. Experimental treatments created by varying presentation technology and content structure.

Experimental subjects (undergraduate students at a small private college) were randomly assigned to the four treatment groups. Each treatment group had 17 subjects. After studying the treatment instructional materials, subjects predicted test performance on each of the eight topics. Upon completion of an objective posttest, a comprehension calibration coefficient (the dependent variable) was calculated for each subject by correlating the eight performance predictions with the actual test scores on the eight topics using the Pearson product-moment correlation.

As noted above, the research literature suggests that subject interest in the study topic, subject expertise in the topic, and subject motivation to perform in the posttest may all be covariates with the calibration coefficient. Length of study time might also reasonably be a covariate. Based on researcher-recorded reading times and subject self-reported measures of interest, expertise, and motivation, no significant covariance was found.

To assess the impact of presentation technology and content structure on subject calibration of comprehension, data generated in the experiments were subjected to hypothesis testing:

1. $H_0$1: There was no significant difference between the calibration coefficients for the computer technology treatment and the paper technology treatment. (Rejection of this hypothesis would mean the presentation technology influences calibration.)
2. $H_0$2: There was no significant difference between the calibration coefficients for linear structure treatment and the nonlinear structure treatment. (Rejection of this hypothesis would mean the linear/nonlinear structure of the instructional materials influences calibration.)
3. $H_0$3: There was no significant interaction effect between the technology and structure treatments as measured by the calibration coefficient. (If hypothesis $H_0$3 were to be rejected, then three more hypotheses would be tested.)
4. $H_0$3a: There was no significant difference between the calibration coefficients for the linear paper treatment and the nonlinear computer treatment. (This hypothesis compared a typical book format to nonlinear computer hypermedia.)
5. $H_0$3b: There was no significant difference between the calibration coefficients for the nonlinear computer treatment and the nonlinear paper treatment. (This hypothesis compared calibration when reading from a website to calibration when reading from a printed copy of the website.)
6. $H_0$3c: There was no significant difference between the calibration coefficients for the nonlinear computer treatment and the linear computer treatment. (This hypothesis compared two different design approaches for hypermedia.)

Experimental Results

The dependent variable, referred to as the "calibration coefficient", was a Pearson Product-Moment Correlation calculated between subjects' self-predicted performance on eight fallacy topics with their actual posttest scores on those topics. The mean value of the calibration coefficient is 0.09 which is significantly greater than zero, $\underline{t}(67) = 1.95$, $\underline{p}<0.05$. The median value of the calibration coefficient variable is 0.15. Figure 2 displays the distribution of the calibration coefficient for the experimental subjects.

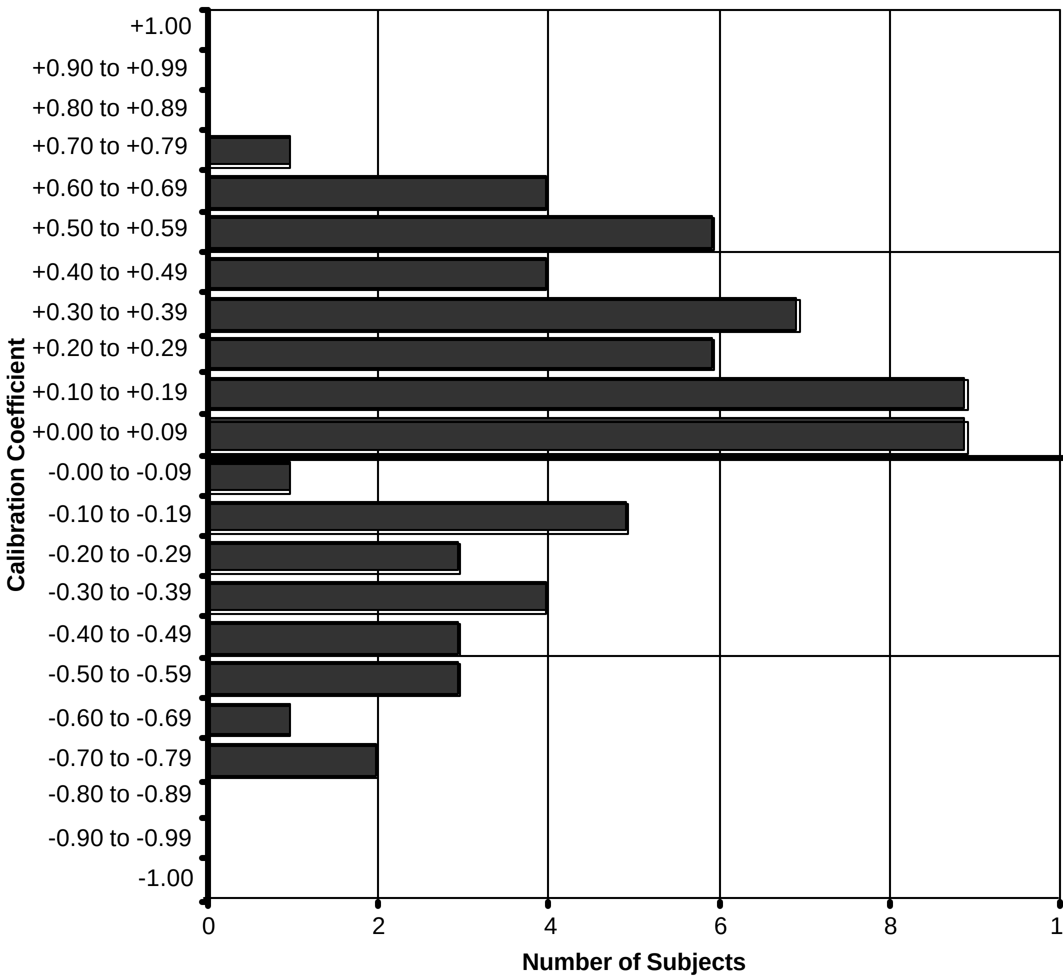

Figure 2. Distribution of dependent variable.

An analysis of variance was conducted to determine if treatments or treatment interactions affected subjects' ability to predict test performance and thus regulate their study processes. As noted in Table 1, treatment effects were not statistically significant nor were there statistically significant interaction effects. Thus, the first three hypotheses are not rejected and the second three hypotheses are not tested.

Table 1. ANOVA with calibration coefficient as dependent variable

Source	SS	df	MS	F
Structure	.176	1	.176	1.251
Technology	.020	1	.020	.146
2-way Interaction	.050	1	.050	.354
Residual	9.005	64	.141	

Post hoc power analysis with $p<0.05$ indicates a power level less than 0.20

Several aspects of the experimental data warranted further investigation:

1. The mean of the calibration coefficients, while statistically greater than zero, was disappointingly low. The 0.9 mean is reminiscent of the earliest calibration research and was expected to be higher since the research meticulously followed guidelines developed in the calibration research literature.
2. The distribution of the calibration coefficient shown in Figure 2 is disturbing. It has the general appearance of a random normal distribution centered on zero and shows a large number of "negatively calibrated" subjects. Negative calibration coefficients imply that subjects consistently score poorly on topics they think they know well and vice versa. Negative correlation is not addressed in the calibration of comprehension literature and has no obvious ties to real world learning

experiences. The negative correlation found in the calibration coefficient distribution suggests a major random process underlying the calibration coefficient.

3. The test questions (along with the instructional texts) have an extensive track record at the host institution. The grade distributions typical for the posttest questions were well known. Posttest scores were lower and more disperse than expected.
4. Reliability analysis and item analysis indicated problems with the test questions. Since extensive past use of the instructional materials and test questions suggest these materials are effective and appropriate together, then low reliability and item analysis scores indicate some other problem in the study methodology.

Taken together, these observations pointed to extensive random guessing by subjects during the posttest phase of the experiment. The randomizing influence of posttest guessing would produce the symptoms noted above.

Interviews

To obtain further insights into the experimental results, two subjects from each of the four treatment groups were selected for interviews. For each treatment group, one subject had a high posttest score and a relatively large positive calibration coefficient. The second subject for each treatment group had a high posttest score and a relatively large negative calibration coefficient. (Only subjects with high posttest scores were selected to make sure the interviewed subjects were actively engaged in the experiment's learning task.)

A thirteen-question telephone interview was conducted with each of the eight identified research subjects. The questions addressed several issues arising from analysis of the experimental data:

1. Effort. Seven of the eight interviewed subjects admitted they would have put much more effort into studying the instructional materials if a course grade had been at stake. Six of the eight subjects estimated guessing at 20%-40% of the posttest questions; one estimated guessing at 60% of the questions.
2. Stopping criteria. Interviewed subjects were ask to describe their study "stopping criteria" – how they decided when to stop studying – for both real world study tasks and for the experimental task. Only three of the eight interviewed subjects used the same criteria in the experiment as they typically used when studying for college courses.
3. Anti-calibration. None of the eight interviewed subjects reported study self-regulation difficulties that resemble anti-calibration.

Based on these interviews, it is clear that subjects were not motivated to study the experimental materials in the same way or to the same extent they study actual academic materials. It can not be assumed then, that the subjects engaged their normal calibration skills either. The extensive guessing during the experimental posttest introduced a large-scale random influence to the experimental data. Thus, it is not clear to what extent the experimental data accurately reflects student calibration in real world settings.

Other Findings

The interviews revealed four types of study stopping criteria:

1. Process criteria. Several subjects described study "rituals" involving reading/re-reading practices, note-taking, or other study strategies. Process-oriented students tended to stop studying once the study process was complete.
2. Feel good criteria. Some subjects reported studying until they felt they knew the materials.
3. Feel bad criteria. Other subjects reported studying until they felt like they weren't getting anything more out of the studying.
4. Time criteria. Some subjects reported studying until they ran out of time and the test was given.

Subjects reported a variety of ergonomic and interface concerns. Eye strain and navigational confusion were mentioned by subjects reading from the computer screen. One subject noted her "body got bored" reading the hypertext – she found the instructional material interesting, but became physically restless having to sit in one position in front of the computer screen. Reading from a book would allow her to change physical positions and read for longer periods of time. Subjects noted they were unable to highlight text on the computer like they did in textbooks. One subject who visualized the book during testing found he could not use the same memory technique when reading from the computer. Two subjects suggested hypermedia would be an excellent tool for reviewing materials already read.

Figure 3 presents one of the most interesting observations from the experimental data. The scattergram shows individual subjects plotted by posttest score performance (x-axis) and predicted performance (y-axis). Regression lines for each of the four treatment groups are shown, along with the R^2 for each regression line.

In examining Figure 3, it is obvious that the LP treatment (the treatment representing traditional studying from a textbook) is noticeably different from the other treatments. The regression line and R^2 for the LP treatment suggests that students who scored better on the posttest were also better able to predict their performance than students who did not mastered the material. This is intuitively appealing, regardless of whether this indicates that better calibrated students learn more or that students who have learned more are better able to assess their knowledge. Note, however, that the other treatments show no such relationship. Since the discussion above has already established that the artificial experimental setting heavily influenced the research data, one cannot presume Figure 3 necessarily represents impacts of the treatments in real world study situations. However, these results do suggest further study is warranted.

Summary

The present study is a pioneering foray into an unexplored issue--the calibration of comprehension in hypermedia environments. In particular, this study was designed to determine if hypermedia instructional materials would impact college students' ability to assess their own readiness for testing.

Two basic characteristics of hypermedia--content structure and presentation technology--were used as variables to define a 2 x 2 experimental design. The content structure variable could be either linear (L) or nonlinear (N); the presentation technology variable could be either paper-based (P) or computer-based (C). The variables define four treatment categories: linear paper-based materials (LP), linear computer-based materials (LC), nonlinear paper-based materials (NP), and nonlinear computer-based materials (NC).

After reading the instructional materials, but before seeing the posttest questions, subjects were asked to predict their test performance on questions for each of the eight topics contained in the instructional materials. The posttest generated eight different scores--one for each of eight topics contained in the experimental materials. For each subject, a Pearson Product-Moment Correlation (Pearson r) was calculated by pairing the eight posttest scores with the eight score predictions. These Pearson r values--called calibration coefficients--served as the dependent variable in the experiment.

Although statistically significant calibration was detected, analysis of variance found no statistically significant treatment or interaction effects. Data analysis and interviews suggest that subjects did not study at the same level of effort or use the same study strategies as used in real-world academic test preparation. This lack of preparation resulted in greater levels of guesswork during the posttest and thus increased randomness in the experimental data. Since students may not have used the same study strategies in the experiment as they use in actual academic coursework, it is not certain whether the findings of the experiment can be applied to actual college coursework environments. However, additional statistical analysis suggests that learning with unfamiliar media may impact calibration of comprehension for some students and that further investigation is needed. Future research seeking to address calibration in academic settings should be incorporated into academic coursework where possible.

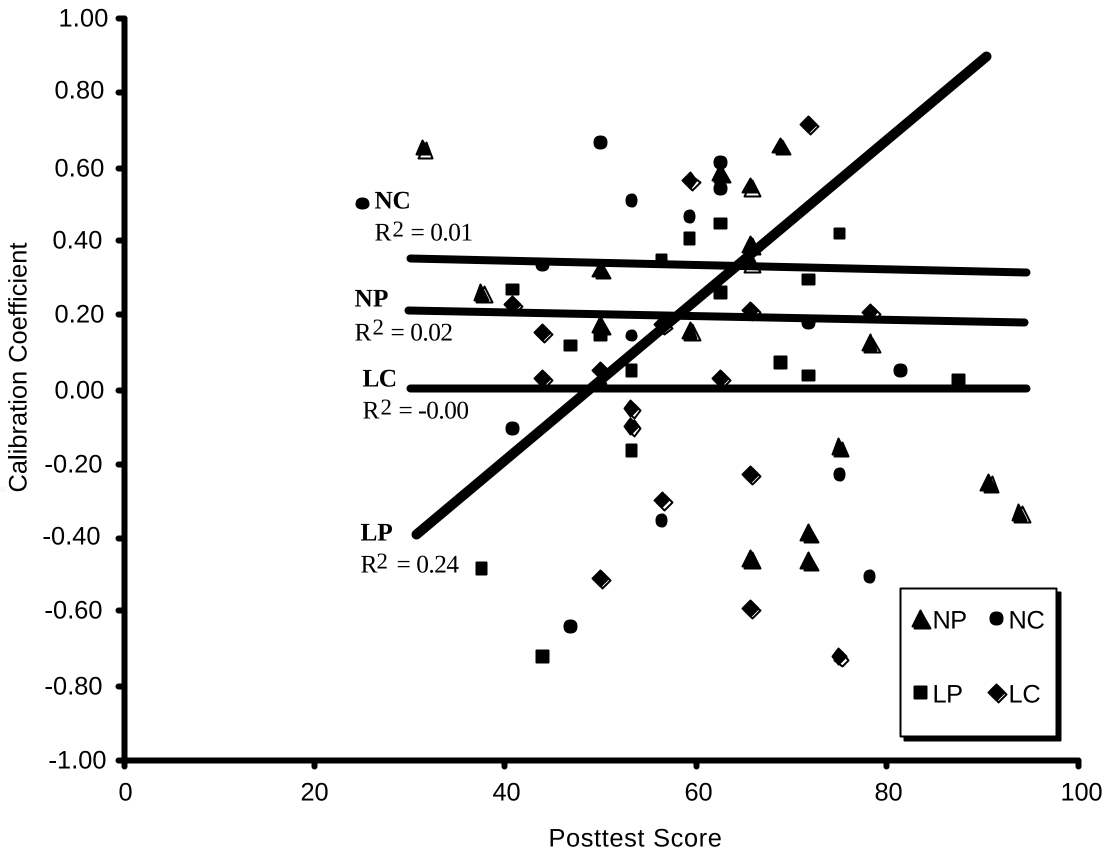

Figure 3. Scattergram of calibration coefficients and posttest scores with regression lines by treatment.

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Learner-Centered Professional Development Environments in Mathematics: The InterMath Experience

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Background

The pedagogical shifts embodied in a series of standards published by the National Council of Teachers of Mathematics (NCTM) emphasize a departure from the teaching and learning approaches typical to American classrooms (NCTM, 1989, 1991, 1995, 2000). National and worldwide assessments such as the TIMSS report (Cochran, 1999 and NAEP (U.S. Department of Education, 2001) confirm that there is a need to carefully examine and improve our educational practices in order to remain a leader in worldwide learning and in worldwide industry. In order to meet the needs of the educational system, we need to rethink the role and format of teacher professional development experiences (e.g., NCSMT, 2000; NPEAT, 2000; National Commission on Teaching & America's Future, 1996; Renyi, 1996; Sparks, 1999).

Several leaders in professional development and mathematics have clearly defined a working plan for improving mathematics teachers' content knowledge and pedagogical content knowledge, as these two factors seem to be critical factors in student learning. Calls for professional development that occurs over a long period of time, that emphasizes teacher thinking and development of reflective dispositions, and that pushes teachers to learn more in their content areas have become pervasive in the professional development literature (e.g., Ball, 1994; Hawley & Valli, 1999; Krajcik, Blumenfeld, Marx, & Soloway, 1994). As pointed out by Kilpatrick, Swafford, and Findell (2001):

> Teachers' professional development should be high quality, sustained, and systematically designed and deployed to help all students develop mathematical proficiency. Schools should support, as a central part of teachers' work, engagement in sustained efforts to improve their mathematics instruction. This support requires the provision of time and resources (p. 12).

This statement is certainly a call for professional development experiences that depart from the "make and take" model that is commonly associated with teacher workshops.

Based on the growing need for constructivist, learner-centered environments (McCombs & Whisler, 1997), National Partnership for Excellence and Accountability in Teaching (NPEAT) has "revisioned" what professional development should look like and be (NPEAT, 2000). Based on current research, and in alignment with other proposals for improving professional development, the NPEAT Research-Based principles provide a guide for professional development. These principles include:

- The content of professional development (PD) focuses on what students are to learn and how to address the different problems students may have in learning the material.
- Professional development should involve teachers in the identification of what they need to learn and in the development of the learning experiences in which they will be involved.
- Most professional development should be organized around collaborative problem solving.
- Professional development should be continuous and on-going, involving follow-up and support for further learning — including support from sources external to the school that can provide necessary resources and new perspectives.
- Professional development should provide opportunities to gain an understanding of the theory underlying the knowledge and skills being learned. (NPEAT, 2000)

In short, teachers should take charge of their learning, be provided with motivational and challenging ways to learn, and should have the opportunity to decide what is most relevant for their students (Hawley & Valli, 1999). NPEAT also asserts that the most successful professional development occurs in a culture of change.

InterMath

One attempt at creating a professional development environment that aims to meet these goals is the InterMath project. InterMath is comprised of a 15-week technology-rich workshop, a website with mathematical investigations and tools to support learning, an ongoing support system that is designed to provide continued support for teachers who have participated in the workshop, and a number of other tools and opportunities to allow teachers to take away what they need for their own success. InterMath was created to help address a critical problem with middle school mathematics – many of the teachers are not knowledgeable enough in their content area or in content pedagogy (SREB, 1998). This is because of the number of middle grades teachers who are either teaching out of field or who have a generalist background. For many subject areas, the generalist degree does not offer a rich-enough content background for the teachers to support students in the classrooms being called for.

The goals of InterMath include the improvement of teachers' mathematical skills and knowledge through open-ended explorations; an understanding and ability to use software to support the development of mathematical thinking; and the creation of a community of teachers who support each other in implementing the explorations-based approach in their classroom. In implementation, there is considerable room for teachers to choose their own path to success – they select which problem(s) they want to work in each of the critical content areas; they select the approach they want to use to solve the problem; and ultimately, the teachers decide the depth of learning they take from the class by choosing to explore more challenging problems, or add extensions to the problems.

It is our view that InterMath provides one approach to learner-centered professional development. We provide the workshop across a full semester, but include tools to allow the continuous growth of an online community. The teachers are given considerable freedom to choose the mathematics that is most relevant to their situation, they are provided with a number of tools from which to select, and they decide what is important in each problem when they prepare their write-ups of their work. While many of the teachers who come to InterMath are not necessarily seeking a reform-based approach to mathematics, they leave with a deepened understanding of the aspects of the NCTM standards that help define a quality mathematics experience. In our interviews with teachers, we have also found that they develop their understanding of learning by experiencing this approach.

This Study

The purpose of this paper is to examine two InterMath pilot workshops and how they were able to meet the goals of learner-centered professional development. We focus on the experiences of the learners, offer insights from each case as well as across cases, and provide suggestions to improve the experience for later learners. The data reported here came only from the workshops and interviews with the teachers and the instructors.

These studies were conducted by participant observer graduate students in each workshop. The observers collected field notes and helped the workshop participants. Another observer (Orrill) visited the larger workshop three times during the course as well. In those visits, the goal was to gain a non-participant view of the learning environment.

Other data collected for this study include tape-recorded interviews with several participants (8 in one class, 4 in the other) and both instructors. There were also informal interviews conducted half-way through the course in the larger group. Student work, published on the Web, was also considered as it provided insight into the teachers' mathematical thinking and technology skills. A survey that asked our participants to discuss the importance of and their comfort with using technology in mathematics was also evaluated.

For the purposes of this study, three weeks of fieldnotes were selected from each class. They came from early in the semester (week 2 or 3), mid-semester (week 6), and later in the semester (week 12-14). All students and instructor interviews were considered. Only the webpages for the interviewed students were analyzed.

The analysis process involved coding and sorting data. We found several emergent categories that came up repeatedly and used those as a framework for our thinking. Those included: Support, Interaction, Barriers, Presentation, and Adoption. Each case is briefly discussed below with a cross-case analysis following.

Case 1

Description

One of the two InterMath pilot workshops took place near Atlanta, GA. Throughout the workshop, approximately 26-28 participants were enrolled. These participants were all full-time middle school teachers in the school district and also University of Georgia graduate students seeking a master's or education specialist degree in middle school mathematics education. Even though the participants were all certified to teach mathematics, some were currently teaching subjects other than math. The teachers participated in the InterMath workshop as their first experience in a middle school program cohort established between their school district and UGA's mathematics education department. While being a member of the cohort was by choice (and acceptance), there was no choice of course selection once the teachers joined the cohort.

The workshop instructor was a full-time professor in the mathematics education department at the University of Georgia and also one of the InterMath developers. There were two mathematics education graduate assistants who served as participant observers during the workshop. The project manager, who visited the class three times during the semester to act as an outside observer, also made additional observations.

The workshop took place at the county's board office computer lab. There were approximately 29 computers in the lab. The computers lined three walls of the room to form a U-shape. In the middle of the lab, there were six long tables that faced an overhead projector screen in the front of the room. There were no computers at these middle tables. The participants themselves chose to sit at the long tables, rather than at the computers during the lecture portion of each class period. On the first table, the instructor set up a laptop computer to connect to the projector. He faced the participants, who sat in the latter five rows, as he taught. No students ever sat in the front row.

The class met weekly in the evening. During the first hour portion of each class, the instructor taught in a traditional lecture-style manner. He demonstrated how to explore InterMath problems using software such as Geometer's Sketchpad, NuCalc, and Excel. The instructor asked a few questions during his demonstrations, but there was little student involvement. The class would then shift to the computers to work on problems, write-ups, and webpages. For the remainder of the class, the participants explored the investigations using various software programs and wrote up their findings to post to their individual web pages. The instructor and graduate assistants walked around the room to assist the participants with technological and mathematical questions, as they requested help.

In our analysis of data, we found the following trends in this setting.

- Over-reliance on the instructor

  The participants seemed to perceive the instructor and graduate assistants as experts. They relied on the instructor, rather than each other for technological and mathematical support. Moreover, they seemed to view the main instructor as the "owner" of the class. Even after seeking help from the graduate assistants, the participants often wanted the instructor's approval. For example, one participant was exploring an investigation where he needed to find the maximum volume for a box. The participant asked one of the graduate assistants how he could incorporate technology in the investigation. More specifically, he wanted to know what technology he could use. The graduate assistant discussed some of his options. Instead of exploring these routes on his own and finding multiple representations of the problem, the participant told the graduate assistant that he was going to ask the instructor which way he should explore the investigation. The participant was seeking a "correct process" for solving the investigation from the instructor. He only wanted to explore the problem the way the instructor/ "owner" saw it.

  The instructor seemed to put himself in the ownership role through the manner in which he structured the class. He directed the workshop conversations and selected which problems to investigate. He sought little input from the participants about exploring the problems he had chosen. The participants were placed in a passive role during the first half of the workshop. In the observations, many were reported as off-task during the lecture/demonstration portion of the workshop. During the second portion of each meeting, participants chose to work individually on their write-ups with little communication with other participants. Yet, in the interviews, the participants relayed the feeling that there was not enough support available during the workshop. This feeling further illustrates the assertion that the participants did not turn to each other for support, but rather saw the instructors as their only source of support. In observations, the second half of the workshop was described as being very quiet other than the sound of clicking and the graduate assistants talking to the participants. We would have liked to have seen more interaction and collaboration among the students during the entire class period.

- View of InterMath

  The data distinguished three categories of the participants' views of the goals and purposes of InterMath. In the first category, participants saw InterMath as a "make and take" activity to take into their middle school mathematics classrooms. They selected investigations for their own use based on the knowledge level of their students, rather than their own knowledge level. Because of this, the participants failed to push themselves to increase their own mathematical understandings. These participants had the misconception that InterMath was for their middle school students, rather than a challenge for themselves personally. This idea influenced problem selection and depth of exploration of a problem, which was evidenced in some of the workshop discussions and by the participants' webpages. In one class, a participant voiced the concern that the investigations seemed very hard for middle school students. The instructor explained that the investigations were meant for the teachers and that the teachers would have to adapt them if they chose to use them with middle school students. Despite this explanation, participants continued to cling to the idea that the investigations were suitable for their middle school students with little modification or thought into how to present such an activity to this age level.

  A second group seemed to view InterMath as technology. They wanted to learn how to use the software tools, but took little interest in using the tools to develop mathematical understandings. In workshop observations, these participants became excited when using the technology and learning something new on the computer. However, very little of their focus was placed on learning new mathematical concepts and making connections. For example, during a one of the workshop classes, one of the graduate assistants showed a participant which button to push to display all the Excel functions she might have needed to create a spreadsheet. The participant said something to the nature of "woo-hoo! I'm finally excited about something in here!" This participant apparently wanted the InterMath workshop to teach her to use the technology more efficiently, rather than using it to deepen her understanding of mathematics.

  The last group saw InterMath as an opportunity to enhance their mathematical understandings. In the interviews, these participants stressed the learning of mathematics over the learning of the technology. Unfortunately, few participants held this view of InterMath. One explanation may be that the participants seemed to have a low mathematical knowledge base. The participants particularly seemed to experience difficulties in the discipline of geometry and thus had trouble making mathematical connections and multiple representations that were crucial in the investigations. However, these were the students who seemed most interested in further exploration of the mathematics and also the most reflective about their own mathematical ability.

- InterMath adoption to the classroom

  Some of the participants had already begun to use InterMath in their classroom before the end of the workshop. Surprisingly, there seemed to be little or no adaptation of the InterMath investigations when the teachers took them into the middle school classroom, as evidenced in workshop observation discussions. This is ironic since a number of teachers mentioned in class that they felt like the InterMath investigations were not appropriate for the middle school level. Late in the semester, one of the participants pulled one of the graduate assistants to the side and shared with her what she had been doing in her middle school classroom. She had assigned her students to choose three InterMath investigations directly from the website to work on and to write-up in two weeks. Apparently, the participant made no modifications on the investigations for her middle school students. Even more, the participant seemed to make no attempt to guide the students as to which investigations they might attempt. The teacher made no reference to having her middle school students work in cooperative groups, but rather asked that each student turn in their own independent write-up.

The manner in which some of the participants incorporated InterMath into their classrooms is not surprising considering how many participants viewed InterMath as a mathematical development tool for middle school students, but not for themselves. In addition, instructing the middle school students to work independently parallels the way the participants themselves worked through the investigations during the workshop. Many of the investigations were not meant for middle school students, but rather to challenge the middle school teachers' own conceptions of mathematics and how it is taught.

In the post-workshop surveys, most of the participants perceived an increase in their ability to incorporate technology and mathematics in the classroom. However, interviews reveal that the participants felt a need for more pedagogical support in taking InterMath into the classroom.

Case 2

Overview

The UGA pilot of the InterMath workshop was held at a center designed for supporting teacher professional development with technology on the University of Georgia campus. The classroom was made up of four rows of two tables that all faced an overhead screen. Each table held four computers, and an instructor's workstation sat at the back of the room. The workshop met one evening per week during the Spring, 2001 semester.

The class began with seven students; however, by the end of the fifteen weeks, there were only four participants in regular attendance. Two of these participants taught eighth grade pre-algebra and algebra at a rural middle school. The other two participants came from a private middle school; one was a sixth grade mathematics teacher and the other was the technology support person who also had a mathematics education background.

A professor from the mathematics department at the University of Georgia led the workshop, and two graduate assistants, one from UGA's mathematics education department and one from the instructional technology department, attended regularly in order to assist the instructor and participants and to collect research data. A third graduate assistant, also from the instructional technology department, attended the first few workshops and supported the participants in learning web publishing.

What the participants DID learn

There were some overarching successes in this pilot. First, the participants learned how to use technology to create and post write-ups of their mathematical investigations. Specifically, the participants learned how to use computer software that included web composers and FTP clients. On average, the participants posted seven write-ups to the internet. These write-ups often included links to spreadsheets and/or dynamic geometry files.

Second, the participants learned to identify and to appreciate certain aspects of reform-based issues in mathematics teaching and learning. As evidenced through their final interviews, the participants noted the value of problem solving, learning through collaboration and communication, finding multiple solutions and answers, and asking extension questions. For example, when asked what students in an ideal mathematics classroom would be doing, one participant commented, "Well, after all this, problem solving." Anther participant said that an ideal classroom to her would be one in which the students are "asking questions and they're showing their classmates what's happening and sharing ideas and thoughts and communicating with each other." A third participant mentioned that the most important things she learned from the InterMath experience were "The importance of thinking and not just computation. ... And collaboration." She also stated, "I've even told my kids that there are lots of ways to find an answer and oftentimes the answer's not the important part." It was clear that mathematics and mathematics education pedagogy were key issues to these participants.

What the participants DID NOT learn

There were also some critical areas in which learning did not occur as expected. Improvement in these areas is a focus in preparing for the next InterMath workshop. First, the participants did not seem to greatly expand their mathematics content knowledge. Approximately 61% of the write-ups posted were about investigations that were taken from the Algebra or Number Concepts units on the InterMath website. These units correspond to the majority of the topics that are covered in middle grades mathematics. Only 25% of the write-ups focused on Geometry problems and only 7% on Data Analysis problems. One participant mentioned that after she and her partner struggled with a problem that was hard, they would simply "close that one up, and we'd do another one." Issues of lack of perseverance and an unwillingness to try new areas, possibly relating to efficacy, were prevalent.

Second, the participants did not become comfortable with using a variety of mathematical software in doing their investigations. Approximately 86% of write-ups indicated that the authors used spreadsheets to help them with the investigations. Not surprisingly, spreadsheets were the only software the teachers had considerable experience with when they began the workshop. Only 18% of write-ups illustrated use of geometry software, and only 4% mentioned the use of graphing software. One participant stated that she and her partner "felt more comfortable using a spreadsheet. And it's just because...that's what we could maneuver better with."

Finally, the participants did not mention any form of proof in their write-ups (it should be noted, however, that the instructor did not emphasize the importance of including proofs in the write-ups). Most of the participants used numeric patterns or measurements to justify their solutions to the investigations. No one offered any conceptual explanations or tried to rationalize why the numeric patterns or measurements must have given the correct answer. More disturbing, they also did not seek to use extensions to push their thinking and/or their students' thinking further, even though that issue was an explicit focus of the instructor. The instructor commented that even when the participants did write extensions, they never tried to solve them. This fact may relate to the same issues that prevented attempts at difficult problems.

Cross-Case Analysis

Several findings emerged that spanned across both cases. There were also some findings within each case that we were unable to reconcile. For example, we are not sure why we lost three of seven students in Case 2. While they reported they each left for personal reasons, the fact that all three were from one school raises questions about how to keep busy teachers engaged in the experience. We can speculate about the role of groups, the need for proper location, etc.; however, there is no clear way to determine whether that trend is one we need to attend to in future cases.

For our cross-case analysis, we adhered to the findings framework introduced previously. We looked at what we found in each case, what was true in both cases, and what we thought might be a reasonable assertion based on the evidence provided.

Support & Interaction

We found that support and interaction became very intertwined in our cross-case analysis. This fact was because most of the interactions between students and between instructors and students were focused on helping the learners be successful in what they were doing. We noted that there were two distinct kinds of interactions: affective (those aimed at providing positive feedback or other information to keep the students motivated) and intellectual (those interactions that provided the information learners needed in order to move on with the problem on which they were working). Based on our interviews and observations, the affective interactions were particularly important between participants. Several times the learners commented that they felt behind or inadequate until they began talking with the other participants or until they began to find out from the support staff that others were having the same kinds of problems. In more than one case, this “same boat” effect prevented our participants from dropping out of the workshop.

Another support/interaction issue that appeared was the overwhelming number of procedural questions that were asked by the participants. In both workshops, until around the middle of the semester, the questions all focused on how to use particular pieces of software. Later, we saw some movement to more process-oriented thinking, but the procedural questions never faded entirely. This finding raises a number of questions about supporting the teachers in getting the learning that we had hoped for from the workshop and about who needs to provide support and what that support should look like. In Case 1, we had about 30 students with three support people (two graduate assistants and one instructor) in Case 2, we had one instructor, one to two graduate assistants, and another graduate assistant who acted primarily as a researcher, but ended with only four students. Even with, or perhaps because of, this presence of knowledgeable others, the teachers resisted engaging with each other for problem solving, instead turning to those perceived as owning information. This phenomenon leaves an open question about whether the students perceived that InterMath allowed them to understand the theory and skills they were learning – after all, if they still felt they needed to seek instructor guidance rather than relying on themselves or their peers, it is likely that they still held the traditional idea that math is about right answers and that the teacher’s role is to have those answers.

Finally, while we provided every opportunity for collaborative learning, few teachers chose to engage in it. Even in those instances where teachers worked as pairs or trios, they tended to each work their own problem and rely on each other only when they were confused or unable to continue. We also found that among the teachers who did work together, almost every group included teachers who worked together in the same schools. These findings combined lead to two insights: first, teachers seem to work with people who they already know and feel safe with; second, teachers are not naturally predisposed to working in groups. This second point may explain many teachers’ reluctance to include groupwork in their classrooms– which reinforces the need for the professional development environment to model the desired classroom environment.

Barriers & Difficulties

There were two main barriers across the two cases: technology and goals. The technology problem was one of both participant inexperience with the tools we were using and hardware problems that were exasperated by participant inexperience with the tools. The technology difficulties were so severe that almost half of each workshop was spent with students struggling to make webpages and publish them. This amount of time was particularly alarming given that the webpage aspect of the class was only a tool for portfolio generation. The technologies that were of greatest interest were tools that allowed mathematical visualization and exploration (e.g., Geometer’s Sketchpad, Excel, and NuCalc/Graphing Calculator). Further, the web development goal was a tiny one as compared to the mathematical aims of the InterMath experience.

The barrier caused by goals was an interesting one. The problem was that the participant goals and the workshop goals were not always in alignment. In our follow-up interviews and surveys, for instance, a large number of teachers indicated that learning technology was their perceived goal for InterMath. Those who reported this, it should be noted, were also quite happy with their experience. However, that was not our intended goal. What we had hoped was to allow teachers to think about teaching and learning mathematics in a different way – certainly technology was a part of that vision, but not the central component.

Another large group of teachers seemed to think that the InterMath workshop provided an opportunity to become familiar with a tool, the InterMath website, that could be used in middle-grades classrooms. While there were some problems that certainly could be useful for middle school students, the purpose and intention of the site was to enhance teacher mathematical understanding.

Because teachers saw the site as being a tool for use in their own classrooms, many completed only problems they felt their students could complete. This meant that many of them did not challenge their own mathematical abilities at all.

On one hand, because the participants were able to define and follow their own goals, they were pleased with the outcome. On the other hand, we have concerns about the kind and quality of learning given that teachers did not seem concerned with their mathematical development.

Adoption

Our final major finding in the cross-case analysis was a disturbing trend among the teachers who implemented the InterMath problems in their classroom to structure their students' learning experiences exactly as their workshop experience had been structured. This was alarming for a number of reasons. First, it demonstrated little reflection on the part of the teachers about their students' abilities in mathematics. They allowed students to randomly choose problems from sets that covered a number of topics and varied in conceptual difficulty tremendously. Further, the teacher participants had complained throughout the workshop, in both cases, that there was not enough structuring because there were not clear guidelines for assignments, etc. Yet, they reported implementing this same kind of approach for their students who did not have the maturity or life-experience upon which to draw to cope in this extremely open-ended environment. In short, it seemed that the teachers borrowed InterMath rather than adopting it. It may be argued that this is the first step of adoption, but it is complicated because we no longer have the opportunity to support these teachers in their efforts.

Further, post survey results indicated that the teachers were not yet comfortable with the implementation. This was perhaps corroborated by the teachers who talked about using demonstration techniques to implement InterMath in their classrooms or those who said they needed more practice themselves before they could implement. While these problems are somewhat different from the wholesale adoption approach with no attention to philosophy, they still prevent the students from having a successful experience with mathematical explorations.

Conclusion

In conclusion, we offer our suggestions for improvement for this kind of workshop experience.

First, it is vital to the success of the workshop that we solve the technology problem. Unless we find a way to shift teacher focus away from the procedural aspects of using the technology, we will not be able to support them in their content knowledge development. While the learner-centered professional development principles do indicate that teachers should be in charge of setting their goals, it seems critical that the learning of procedure needs to somehow be removed from the prominent position it held in our pilot workshops. Some ways of supporting teachers in the technology area might include setting prerequisites for taking the workshop, creating a forms-driven webpage publishing approach, or rethinking the role of online portfolios in the InterMath experience. We could also provide special technology skills workshops for the participants. From a more systemic view, it seems that schools need to support a higher level of technology literacy among their teachers. All of our participants had completed some kind of basic technology training, yet they did not know how to accomplish their goals either conceptually or procedurally.

For the goal alignment problem there are several potential solutions. First, consistent with the NPEAT standards, more professional development opportunities should be aimed at supporting teacher conceptual development rather than activity generation. Further, we learned that simply telling the participants about the intentions of the workshop was not enough. They need to be challenged through the structuring of the workshop to push themselves. Further, they need to have the opportunity not only to own the goals they are aiming for, but also to own the workshop itself. Participants need to feel that they can work with the instructor(s) to steer the professional development program for their success. Finally, we need to look for ways to let the need for technology arise out of the mathematics so that the teachers first explore what mathematics and mathematical knowledge are, then look for ways to solve the problems. The technology should be one of a host of tools that they are comfortable with and able to use in the learning environment.

Finally, the adoption issue. From our experience in these two classes, it seems reasonable that a first step toward more meaningful adoption by the teachers would be to attack the problem head on – to discuss ways to implement InterMath with the teachers, to look at ways problems might be modified to more appropriately meet the needs of middle school students, and to discuss the value and learning that might come from using the investigations. A second approach might be to model a classroom approach to using the problems with the students. In this way, we would provide a safe environment in which teachers can think through the issues involved with implementation before affecting students. Finally, our ongoing goal of creating a lesson plan database may help with the adoption process. The database will provide InterMath participants with access to tested lesson plans that other teachers have used in their own classrooms.

In conclusion, InterMath offers one view of a research-based professional development endeavor. In our initial implementation we learned much about the successes and pitfalls of working within this kind of framework.

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Cost-Benefit Analysis: Case study of the Distance Master of Science Program in the Department of Instructional Systems Technology, Indiana University

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Abstract

The Instructional Systems Technology Distance Master of Science program is one of the first degrees of its kind to be offered at Indiana University. Other than an initial on-campus orientation, it can be completed entirely via the Internet. The first course for this program was offered Fall of 2000 with eighteen students enrolled. This same semester, a research team analyzed the monetary costs and pecuniary benefits of this program in a cost-benefit analysis. They identified the costs and benefits from the perspective of the department. Using these, they calculated the costs to benefits ratio. Although the team concluded that the distance program had a high costs to benefits ratio, there are many value benefits which were not monetarily included in the analysis. This report also offers recommendations for further cost-benefit analyses of a distance education program.

Introduction

For Fall semester 2000 the Instructional Systems Technology (IST) department in the School of Education at Indiana University established an online Distance Master of Science (DM) program. It was designed and developed to mirror the on-campus IST Master of Science program.

As part of the on-campus course *R563: Business and Economics of Training and Development*, a team of six students conducted a cost-benefit analysis (CBA) for the DM program in the Fall of 2000. Literature shows that most studies of online learning environments have been conducted to examine educational advantages and to explore effective design strategies (Jung & Rha, 2000). In contrast, the R563 team, working with Dr. Charles Reigeluth, Director of the DM program, focused their analysis on the monetary costs and benefits to the IST department and/or the School of Education. For simplicity, these will be referred to as “the IST department” or “the department.”

By presenting a breakdown of the developmental and ongoing costs and benefits, this report provides information from which the IST department could base future DM program decisions. This report may also be useful for others who are responsible for the design, development, implementation, and maintenance of distance education programs in higher education.

Literature Review

Distance Education

According to Molenda (1996), “distance education refers to a program of some duration, leading to formal recognition of achievement, in which the learner is separated from the instructor and in which special arrangements have been made to facilitate dialog between the remote students and an instructor.” Keegan’s (1980) definition of distance education is still widely used today. He defines the principle characteristics of distance education as the separation of teacher and learner; influence of an educational organization; use of technical media; provision for two-way communication; and possibility of occasional meetings.

In general, educators believe that distance education is subject to economies of scale and that the primary benefit of this form of education is that costs can be distributed over a large number of students. It is seen as a probable money-making venture because of the greater number of students who could potentially enroll versus traditional on-campus programs. The higher the revenue overall, the lower the cost per student would be (Inglis, 1999; Whalen & Wright, 1999). While this potential to exploit economies of scale exists in distance education, it does not mean that only programs with high student enrollment can be cost beneficial (Curran, 1995).

Cost-Benefit Analysis

When conducting a cost-benefit analysis, dollar amounts are examined for both the costs and benefits. The costs are then compared to the benefits in a costs to benefits ratio. This allows one to determine the extent to which the monetary value of a program's benefits outweigh the costs (Sikorski et al, 1991). If the decision were purely economical, a program would exist only if the costs to benefits ratio were less than one, meaning, monetarily, benefits have exceeded the costs.

An advantage of cost-benefit analyses is that programs can be directly compared no matter what their platform, desired outcomes, values, and delivery systems are. Everything is converted to monetary values and thus can be directly compared.

The primary disadvantage of a cost-benefit analysis is that oftentimes it is difficult, if not impossible, to account for every foreseeable cost and benefit in monetary amounts (Levin, 2000). This is especially true for certain value-based benefits, which are often left out of a CBA (Cukier, 1997). For this reason, it is important to consider other cost-analyses, such as cost-effectiveness, cost-utility, and cost-feasibility when deciding whether or not to pursue a particular program.

Measuring Costs

As part of a study conducted at Marshall University, Morgan (2000) divided costs into categories to help determine the cost of online courses. Based on this study, three main cost categories emerge:

1. *Capital and recurrent costs*: These occur on an ongoing basis, such as technology support, equipment upgrades, indirect costs, and course maintenance.
2. *Production costs*: These are incurred during the development of courses, including factors like providing software to students.
3. *Delivery costs:* These costs are associated with teaching a course, such as instructor salary, course-related mailings to students, and opportunity costs related to teaching a course instead of doing an alternative.

These costs can be broken down even further to include hidden costs, technology specific costs, support personnel costs, faculty training costs, and/or administrative costs (Morgan, 2000).

Whalen and Wright (1999) compared the capital, production, and delivery costs of online courses with the costs of equivalent courses taught in the classroom. They made the assumption that the learning outcomes were the same. Their capital costs included the cost of the server which housed all courses. They divided production costs into six areas: instructional and multimedia design costs; the cost of producing text, audio, video, graphics, and photographs; the costs of authoring and delivering software, or the cost of licensing and delivering commercial software; the costs of testing and modifying course content; student and instructor training costs; and final course testing costs.

For their analysis, they also divided their costs into fixed and variable costs. They defined fixed costs as costs that remain the same regardless of the output and variable costs as those that vary directly with the amount of output—so fixed costs are the same no matter how many students are in a course, while variable costs increase with the number of students.

They determined that online courses tend to have higher fixed costs than classroom-based courses, but that these costs are offset by lower variable costs. Due to the reduction in course delivery time and the potential to deliver courses to a larger number of students, they found online courses to be more cost-beneficial than classroom teaching.

Whalen and Wright chose to ignore costs that would have been incurred had a course been delivered in a classroom (sunk costs) in their analysis on online courses. They identified these costs as instructor salary and benefits, equivalent costs of course development, course materials, administrative support, and classroom overhead.

After gathering cost information for both online and traditional courses, Whalen and Wright used costs to benefits ratio analyses to determine the breakeven number of students required to recover costs over five years.

In a similar study, Bartolic-Zlomislic and Brett (1999) analyzed costs and benefits of an online graduate course at the University of Toronto. Their analysis projected that the online course would likely make a profit of 1,962 Canadian dollars per year. They also calculated that 19 students would be needed to achieve a breakeven point.

Measuring Benefits

When he estimated monetary value, Cukier (1997) divided benefits into three categories:

1. *Performance-driven benefits*: These include cost savings, revenues, and other income. These benefits are usually the easiest to quantify and thus lend themselves easily to a cost-benefit analysis.
2. *Value-driven benefits*: From a departmental perspective, these may include time efficiency, flexibility, consistency in quality of delivery, ease of access to the technology, the quality of student-teacher interaction, the rate and ease by which material can be updated and changed, the appearance of being at the cutting edge of technology, opportunities for on-campus students to produce the online course, and expansive delivery with limited interaction.
3. *Value-added, societal, or indirect benefits:* These include reduction in capital investments (fewer buildings and parking lots), reduction in pollution, increased job creation, new business opportunities (telephone companies, publishers), reductions in social community costs, the creation of secondary markets, time savings, revitalizing a curriculum and faculty, reaching new markets, and increasing student diversity.

An organization may adopt a value-based approach to a CBA to stress the importance of understanding the pedagogical needs and values when judgments are made about costs and benefits. The main strength of a value-based approach is that it allows for a subjective definition of benefits, therefore making it a flexible technique (Cukier, 1997). Such an organization may decide that a program which may have a high costs to benefits ratio is still worth pursuing because of the value it offers.

All benefits, as well as costs, are determined on a program by program basis as each organization has differing pedagogical needs and values. For example, one possible value-driven benefit for an online program might be expansive delivery with limited interaction. However, for another organization which values interaction, this would be viewed as a cost.

Measurement

The data were collected from four separate sources:

1. *Cohort Study:* Data concerning faculty salaries were taken from the Cohort Study located in the Dean of Faculties at Indiana University.
2. *Questionnaire:* General data regarding the use and opinions of the DM program were gathered using a survey questionnaire. It was distributed to and filled out by several faculty members, staff members, and graduate assistants who were directly involved in the program.
3. *Personal Interviews:* From the respondents of the questionnaire, the team selected individuals to be interviewed. They were: Dr. Charles Reigeluth, Director of the DM program; Dr. Robert Appelman, Head of Technical Support; Prof Elizabeth Boling, IST department Chairperson; Carthel Everett, Contract and Grants Specialist in the School of Education; Susie Sloffer, DM program graduate assistant; and Bill Dueber, technical support graduate assistant. These interviews focused more specifically on costs and benefits regarding the DM program.
4. *Online Resources:* Websites on various distance education programs at Indiana University and at other institutions added to the general knowledge and understanding of costing a distance education program. Of these, the most beneficial was Morgan's (2000) study.

Methodology

Gathering Cost Data

Based upon Morgan's (2000) study, the team gathered cost information for the first academic year of the DM program and placed it into the three categories:

1. *Capital and recurrent costs*: Server, server administration, data communications charges, maintenance, equipment, technological support, and indirect costs.
2. *Production costs*: Faculty training for online course tools, course development, course materials, and licensing software.
3. *Delivery costs:* Instructor salary and fringe benefits, director salary, graduate assistant support, adjunct instructor wages, and opportunity costs.

Gathering Benefit Data

The team organized the benefits for the first academic year of the DM program based on Cukier's (1997) benefit categories:

1. *Performance-driven benefits*: Funding for development, student tuition, and technology fees.
2. *Value-driven benefits*: Time efficiency, flexibility, ease of access to the technology, the rate and ease by which material can be updated and changed, the appearance of being at the "cutting edge" of technology, opportunities for on-campus students to produce the online course, and expansive course delivery to capitalize on economies of scale.
3. *Value-added, societal, or indirect benefits:* Reduction in capital investments, increased job creation, time savings, revitalizing a curriculum and faculty, reaching new markets, and increasing student diversity.

Results

Costs and Benefits

The results of the data are summarized as follows (see Appendix A for the detailed breakdown):

ACTUAL COSTS AND BENEFITS	TOTALS
Benefits	$91,606.40
Less: Costs	$177,159.41
NET	($85,553.01)

Using the cost and benefit data, the team calculated the costs to benefits ratio.

Costs to Benefits Ratio

Costs	$177,159.41
Benefits	$91,606.40
Ratio	1.93

This ratio shows that costs for the DM program are nearly twice the monetary benefits.

Discussion

DM Program Costs to IST

It is clear that the IST DM program is not a money making venture. But, it must be remembered and emphasized that this program was not launched nor was ever intended to be a profit producing entity. The motivation behind the DM program was, quite simply, to investigate the possibilities of offering an online program that would mirror the experience of the on-campus Master of Science program. Because of the current staffing situation and the labor-intensive nature of delivering an equivalent online degree, the enrollment has been capped at 20 students per course.

The team was able to approximate the indirect costs using percentage breakdowns provided by the School of Education. This data was then inserted into the cost calculation model from Marshall University. Some of the categories from Dr. Morgan's model did not apply to the IST DM program. For instance, the IST DM program was given the go-ahead from the School of Education on July 1, 2000 to begin in the Fall 2000 semester. The department had approximately one month to prepare the coursework. Thus, the IST DM program generated revenue in the first year. Dr. Morgan's model devotes the first year of a distance education program strictly to development with no student enrollment. Therefore, there were no monetary figures for performance-driven benefits.

Dr. Morgan's model also calls for costs of technology investment. However, the IST DM program had, and has, an extensive existing infrastructure within the School of Education and Indiana University. Because of this, the department did not have to purchase any extra equipment, including servers. There is also existing technology support that is provided for by the indirect costs. In their interviews, professors indicated that, in the near future, there will need to be an investment into technology support and maintenance for the DM program to continue. These are costs that will need to be considered in the future.

In this analysis, the team did not factor in opportunity costs. The Department has not assigned monetary values to the cost (or perhaps benefit) of not pursuing other teaching opportunities instead of the DM program. According to some survey responses, it takes roughly twice the time to prepare for and teach a DM course during this first year. The university currently pays the instructor the same amount for teaching an online course as it would for an on-campus course. The underlying assumption is that the time commitment for a distance education course is no greater than an on-campus course. This additional time could be spent mentoring students, serving on dissertation committees, conducting research, and publishing.

DM Program Benefits to IST

Of the three categories of benefits that the team used, only the performance-driven benefits had a specific dollar amount identified by the department. Value-driven and value-added benefits are not necessarily tangible, and thus more difficult to assign a monetary value. This does not mean these benefits are less important. To the contrary, value-based benefits may be the most important benefits in a distance education program. Moreover, depending on the pecuniary values assigned to value benefits, the total benefits may far outweigh the total costs. It is possible that this is the case in the IST DM program.

Performance-driven benefits:

- *Revenue generated:* Tuition, DM fees, and the startup money.

Value-driven benefits:

- *Institutional prestige*: By having a distance education program, the reputation of Indiana University, the School of Education, and the Instructional Systems Technology department as being on the cutting edge of research and technology is fortified.
- *Learning and applying opportunities*: Students in the on-campus program have opportunities to assist in producing the courses for the DM program. This provides the on-campus students with an opportunity to apply the skills they have learned by producing authentic online courses.
- *Publication possibilities*: The IST DM program provides numerous possibilities for faculty and students to conduct research that may lead to publication.
- *Anytime and anywhere*: Students in the DM program can complete their assignments when it is convenient for their schedules. The flexibility offered with distance education is not possible in an on-campus course.

Societal or value-added benefits:

- *Increased student diversity*: The DM program offers students that have career, family, or geographic constraints the opportunity to obtain a degree from the IST department. These students may have no other way of obtaining this degree.

- *New job creation*: With the DM program in place, two extra Graduate Assistant positions were created to help handle the extra workload. These positions would not exist without the DM program. Having these extra positions available may attract students who might otherwise attend a different institution.
- *Potential to revitalize the faculty and/or curriculum*: Having a distance education program can be a new source of motivation for faculty and staff members of a department. It can be seen as something new and exciting. Also, converting course material into an online version can inspire revisions in course content.

Recommendations

One of the most important steps in conducting an accurate cost-benefit analysis is converting all the costs and all the benefits into monetary amounts. This is very difficult, especially for the value-based benefits. In fact, the IST department did not have figures for these benefits. When conducting a cost-benefit analysis, it is recommended to have monetary amounts established for all costs and all benefits. Each institution should determine the value of these benefits, independently.

It is recommended that tuition be increased if the DM student enrollment is to remain capped at 20 students. Presently, all DM students pay residential tuition rates. This could be raised, especially for the DM students who are not residential students. The $30 DM fee could also be raised. These changes in tuition and fees would lower the costs to benefits ratio.

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Technology Integration and Innovative Teaching Practices: A Staff Development Model for Facilitating Change

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Abstract

Thirteen K-12 teachers participated in a technology integration professional development course that included course components such as peer modeling, peer collaboration, and reflection in an authentic learning context. The study purpose was to explore how teachers' beliefs, practices, and self-efficacy changed in this learning environment. Preliminary results indicate evolving teacher beliefs and practices as related to these course components. Results also indicate a significant increase in teacher self-efficacy, based on pre- and post-course survey scores.

Introduction and Background

While literature shows that barriers and challenges to effective technology integration exist even among exemplary users (Becker, 1994), it may be possible to address some of these barriers through professional development strategies. For example, research suggests that peer modeling and reflection may be effective strategies to move teachers along the technology integration continuum (Bandura, 1997; Dwyer, 1996; Gilmore, 1995; Schunk, Hanson & Cox, 1987), such as moving from a traditional to a constructivist (or integrated) learning environment (Grabe & Grabe, 1998). Peer modeling of effective teaching and technology integration strategies may result in increased teacher confidence and competence (Bandura, 1997; Gilmore, 1995; Pintrich & Schunk, 1996).

Further, providing models of exemplary teachers in a staff development setting may facilitate changed teacher beliefs about technology integration through structured exploration of those beliefs (Ertmer, Gopalakrishnan, & Ross, 2000). Seeing other teachers similar to oneself in a successful technology integration capacity may cause one to examine and possibly revise those beliefs.

A related professional development strategy is teacher collaboration, whereby teachers share ideas and strategies through discussion with computer-using peers (Dwyer, Ringstaff, & Sandholtz, 1991; Hadley & Sheingold, 1993). Research suggests that peers provide emotional and technical support in the classroom (Dwyer et al., 1991; Hadley & Sheingold, 1993) and are found in exemplary-user environments (Becker, 1994). If such strategies are developed and implemented, we may increase the likelihood that teachers will use classroom technology to enhance the critical thinking and problem solving abilities of school children.

Research Purpose

Thirteen K-12 teachers participated in a professional development course, which included components such as peer modeling (including a CD-ROM model of exemplary technology-using teachers), peer collaboration, and reflection. The research purpose was to explore how this staff development model, incorporating such components as reflection, collaboration, modeling facilitated changes in (1) teachers' beliefs about technology integration; (2) teachers' technology integration practices; and (3) teachers' self-efficacy beliefs about incorporating technology. This study explores how teacher beliefs, practices, and self-efficacy changed in this authentic learning environment.

The study was guided by the following research questions:

1. How do teachers' beliefs about technology integration (e.g., role of the teacher, assessment) change using reflection, collaboration, and modeling in a staff development program?
2. How do teachers' technology integration practices (e.g., assessment strategies, curricular emphases) change using this staff development model?
3. How do teachers' self-efficacy beliefs about integrating technology change using this staff development model?

This paper will address preliminary results obtained from initial and post-course teacher interviews, course assignments, and a self-efficacy survey instrument.

Methodology

Participants

Thirteen participants in the technology integration professional development course comprised our purposive sample. Twelve teachers agreed to participate in the study at various levels of involvement. Five teachers participated in the study in a limited capacity, agreeing to share course assignments and complete surveys specific to self-efficacy relative to technology integration. One teacher agreed to participate in interviews, surveys and to share her course assignments. Six teachers agreed to participate in semi-structured interviews, observations and a self-efficacy survey, as well as share their course assignments.

The participants came from four private schools in a Catholic diocese in a Midwest city and represented a range of grades, levels, and content taught. School demographics of the course participants are provided in Table 1. Teacher information and demographics on participants and their classes are provided in Table 2.

Table 1. School Demographics for Spring 2001 (Names are pseudonyms)

Name	Student Population	Ethnic Makeup	Grade Level
Hilltop	285	Approx. 4%	Pre-K to 3
Fairview	293	Approx. 9%	Pre-K to 6
Middleton	133	Approx. 4%	Grades 4-6
Elm Creek	375	Approx. 3%	Grades 7-12

Table 2. Demographics for Research Participants – Spring 2001 (Names are pseudonyms)

Teacher Name	Research Participation Level	School	Yrs Tchg	Teacher Degrees Obtained	Grade Level	Content Taught	Class Size	Classroom and Lab Computer Resources
Caroline	Extensive	Hilltop	23	M.S., Elementary Education	3rd	All subjects	Began with 22; ended with 19	Mac and PC available; 3 classroom computers; printers, digital camera, scanner
Clara	Extensive	Hilltop	9	B.S., Elementary Education and Language Arts	1st	All subjects	18	Five computers; scanner, printer, 2 IBM computers, 1 I-Mac, 2 Macs
Greta	Extensive	Hilltop	18	M.S., Education	2nd	All subjects	19	2 I-Macs, printer
Kathy	Extensive	Fairview	6	B.S., Elementary Education	3rd	All subjects	Began with 18; ended with 19	1 I-Mac, 1 Apple, 2-Emates, printer

Table 2 (Cont'd.). Demographics for Research Participants – Spring 2001 (Names are pseudonyms)

Teacher Name	Research Participation Level	School	Yrs Tchg	Teacher Degrees Obtained	Grade Level	Content Taught	Class Size	Classroom and Lab Computer Resources
Eleanor	Extensive	Fairview	10	B.A., Elementary Education	4th	All subjects	26	2 Apples, 2 Macs, and a printer. Library: 2 I-Macs, approx. 10 E-Mates. Several people in building to ask for help.

Jennifer	Extensive	Elm Creek	15	B.S., Math.	7th and 8th	Math and Geometry	21	Computer, scanner, Fax, printer; access to computer lab
Julia	Extensive	Elm Creek	5	B.S., Home Economics	7th and 8th	Family Living; Clothing Construction	17-18 (Est.)	Access to computer lab
Amelia	Limited	Elm Creek	25	B.A., Social Studies Ed., M.A., U.S. History	9-11	U.S. History, World History	--	Access to computer lab.
Anne	Limited	Elm Creek	--	Masters, English Education	11-12	English Literature	--	Access to computer lab.
Ruth	Limited	Middleton	47	B.A., Elementary Ed., M.A., Elem. Admin.	4th	All subjects	--	2 I-Macs in class room; 28 Macs in computer lab
Martha	Limited	Middleton	13	Masters, Admin. and Supervision	Principal (18 yrs)	--	NA	I-Macs; access to computer lab
Sarah	Limited	Middleton	--	B.S., Elementary Ed., B.S. in Special Ed.	5th	All subjects	--	2 I-Macs in classroom; access to computer lab.

Research Design

The study was primarily qualitative, using a case study methodology. Quantitative and qualitative data were gathered specific to self-efficacy about classroom technology use. The qualitative data were gathered to explore and describe teacher beliefs about technology integration, changes in technology goals and teaching practices, and their self-efficacy beliefs with regard to technology use. Quantitative data were also gathered to examine teachers' levels of self-efficacy with regard to classroom technology use. Data will continue to be collected during the Fall 2001 semester to allow time for changes in beliefs, perceptions, and practices to emerge.

Procedure

The Spring 2001 semester-long professional development course was conducted once a week in three-hour sessions. Using electronic and peer models of technology integration, the course was set up to facilitate discussion about technology integration issues and to identify different strategies that might be used in the teachers' classrooms.

The course components included (1) presentation of information on problem-based learning (PBL), (2) a series of facilitated discussions, (3) presentation of the electronic models with related discussions, (4) course readings, and (5) the collaborative development of a technology-based PBL unit. These course components were based upon ideas and strategies that the teachers found useful from their experiences and knowledge gained during the course discussions and activities. The teachers also were asked to submit reflections on the various parts of the technology-based PBL unit.

Instruments

Primary data sources included initial and post-course teacher interviews, observations of teacher classrooms, surveys, course discussions, and course assignments. Course assignments included teachers' visions of themselves as technology-integrating teachers (at course outset and course end), development of a technology-based PBL unit for their classrooms and accompanying reflections. During the class sessions, group discussions occurred specific to teacher ideas about what they were seeing and how that tied in with their views and goals.

Initial and post-course interviews were conducted to learn about changing teacher visions, beliefs (i.e. teacher views about classroom organization and management, assessment) and practices specific to technology integration, as well as changes in self-efficacy. The first interview was conducted in February 2001, approximately one month after the outset of the course; the second interview was conducted in June of the same year, the week following the end of the course. Two interviews were planned for the following term (Fall, 2001) to continue to explore evolving teacher beliefs and visions, classroom practices, and changes in self-efficacy.

Observations were conducted during the course to observe class activities and teacher discussions. In addition, classroom observations of the key participants were conducted on a weekly basis to observe teacher classroom practices and technology use.

Teachers also completed a pre- and post-course online survey relative to teacher confidence (self-efficacy). This survey is currently being administered mid-term Fall 2001 to revisit changes in teacher confidence.

This survey instrument, specific to teacher confidence about their technology integration practices (self-efficacy), is an adaptation of an instrument developed and tested in Fall 2000 (Ertmer, Conklin, Lewandowski, Osika, Selo, & Wignall). The constructed instrument has three categories (planning for classroom technology use, technology classroom implementation, and assessment of classroom technology use and impact, respectively), with 10 items each, for a total of 30 items. The instrument, based on a five-point scale, asks for responses ranging from "Very confident" to "Not at all confident." Item examples follow:

Relative to *planning* for technology use, I am confident that I can:

1) define teacher/student roles in a technology-integrated classroom.
2) plan classroom activities that facilitate technology integration.
3) plan for the use of computers with large-group instruction.

Data Analysis

Introduction

Initial course assignments have been analyzed, as have self-efficacy data. Specific to teacher confidence (self-efficacy), the preliminary analysis has been conducted on initial and end of term teacher interviews and surveys.

Quantitative Data Analysis

Data were analyzed for the 12 course participants, based on their pre- and post-course survey results. Paired t tests were conducted for the self-efficacy survey instrument; reliability was also measured, using Cronbach's alpha.

Qualitative Data Analysis

Interview data (pre- and post-course) for the key participants (seven teachers) and pre- and post-course teacher profiles on teacher technology visions (all 12 course participants) were analyzed and coded inductively specific to teacher beliefs, practices, and self-efficacy (confidence), using cross-case and within-case analysis. Examples of emergent codes include "Contributors to Learning," "Technology Practice," and "Contributors to Confidence." This coding was done using Atlas.ti®, a qualitative analysis software package produced by Scientific Software Development.

Results and Discussion

Quantitative Data Results

At the course outset, teachers' self-efficacy scores averaged from 1.1 to 3.0, with a mean score of 2.2 (five-point scale) and a standard deviation of 0.67. At the end of the course, teachers' scores averaged from 1.2 to 4.0, with a mean score of 3.4 and standard deviation of 1.0. Using the paired t-test on pre- and post-course data, a value of 6.66 was obtained, significant at 0.0001. Instrument reliability for the self-efficacy instrument, based on pre-course data was 0.98; post-course reliability was 0.99.

Qualitative Data Results

Preliminary data analysis suggests the following emergent themes:

- Contributors to learning (including components of the staff development model) viewed as useful varied with individual teachers, although, the more "active" types of learning—peer models and collaboration, hands-on experiences working on the PBL technology unit, and class discussions were mentioned most often as contributors.
- There are indications of some teachers' revising their beliefs with regard to technology (the role of the student, for example).
- Overall, at course end, teachers reported an increase in confidence with regard to technology use. Contributors to this increased confidence included knowledge increase, hands-on experience, peer support, and feelings of accomplishment. Confidence indicators included experimentation (willingness to experiment with technology in the classroom) and increased student technology use.
- Teacher technology practices included increased student technology use, including using their students to teach them. Teachers still expressed concern about assessment, classroom management and classroom organization with regard to technology use.

Contributors to Learning: Consideration of the Staff Development Model

Course components valued as learning contributors varied with the individual teacher. The strongest contributors to learning, based on post-course interviews with those teachers who participated extensively in the research, appeared to be peer collaboration and peer models (other teachers), hands-on experiences, and class discussions. To a somewhat lesser extent, the course reflections, course readings and the electronic peer model (CD-ROM) were also mentioned as being contributors.

Clara, Greta and Caroline, all teachers at Hilltop Elementary in grades 1-3, respectively, collaborated together on their technology-based PBL unit. Of the contributors to their learning, Clara and Greta both mentioned peer collaboration as being valuable. According to Clara:

I think the biggest thing was the peer collaboration, because Caroline was so wise, in, you know, in her knowledge…where Greta and I were lacking…even the confidence…So that, and feeling that we had someone that did know part of what was going on; and it was neat working with Caroline because we found out she didn't know everything. And some of the things we learned together. [Post-Course Interview, June 4, 6, 2001]

Greta also appreciated the support that Caroline gave to her. Further, it appears that Caroline (who acted as an informal technology coordinator for the school) acted as a peer model for Greta.

…I think Caroline was such an awesome…leader for us. She gave us a lot of—but, at the same time, a lot of the things she did—we just watched…And so, I'm hoping that I can take what I saw her doing and try and do myself. [Post-Course Interview, June 4, 6, 2001]

Greta found that her contributors to learning included the electronic peer model and the class discussions, as well as the hands-on experiences provided.

Hands on--I liked the opportunity to do the things…but class discussions, seeing what the other people were thinking and feeling and--and doing in class. Like we would watch a video…where we would go…and see some of the teachers in action. [Post-Course Interview, June 4, 6, 2001]

Caroline found that her contributors to learning were based on the course readings, the class discussions and the reflections. With regard to the reflections:

And the thing that's least--we griped about those reflections…But…it did make you think…and--and then I would re-examine something--even though I'd said it two reflections before, now maybe I'm looking at it in a little different way…or, um, I see where I can improve it or know that it's not even possible… [Post Course Interview, June 4, 6, 2001]

At Fairview, Kathy (a third grade teacher) and Eleanor (a fourth-grade teacher) also collaborated together on their project. Kathy found working with Eleanor helpful, as well as the class discussions.

Well, definitely the class discussions, especially the one that we had on the security issues and privacy…I liked that one a lot. Um, and working with Eleanor helped a lot…She --she'd always have so many great ideas--I love working with her. [Post-Course Interview, June 6, 2001]

Eleanor found the hands-on experiences of the project most useful: "…All of that contributed. And, but actually doing it….The hands-on was the most--yeah, for me…" [Post-Course Interview, June 7, 2001]

It is interesting to note that these teachers overall selected more "active" methods of learning—hands-on experiences, working with others, participating in class discussions. While these components were mentioned frequently, it should also be noted that reflections and course readings were also mentioned as learning contributors. It is also possible that the electronic peer model (which was used in the course a couple of times) might have been a stronger contributor with more use.

Changing Teacher Beliefs

For some teachers, existing teacher beliefs about technology changed or were enhanced with regard to technology use. Clara learned early in the term that technology could be used as a tool, rather than her earlier conceptions of how she should use it in the classroom.

I've learned, mainly, that technology is a tool; and I think before I thought, in reading these things and really thinking about it, I was thinking technology more as a subject?…And that-- that--I teach across curriculums…I was looking at technology as another subject area, rather than seeing is a tool that enhances subjects areas I already have, so that's where my whole thinking has changed, and I can see now that this can be a really great, effective way to teach some of the--my areas to enhance them… [Initial Interview, February 8, 2001]

When asked at course end what the main thing that she had learned was, Clara reiterated, "All right, the biggest thing for me is that I know the computer is a tool. Where before…I had the idea that they wanted me to use the computer for almost everything." [Post-Course Interview, June 6, 2001]

Although her beliefs about the value of technology had not changed, Jennifer, a 7th grade Math teacher, spoke of revising or revisiting her beliefs about the role of the teacher, specifically teacher-directed learning in the classroom. Class discussions and course readings reinforced her beliefs.

To a certain degree I would have to say that my ideas about technology have not changed that much. Prior to this course I felt technology was an important tool for educators to use to help better educate our students. I think that the ideas we have discussed and the material that I have read have just reinforced this belief. In fact, I am more motivated and convinced that I need to find even more areas to implement technology into the curriculum.

As a result of developing my problem-based unit, I have learned, or been reminded, that technology makes learning more student-centered. I think I would be very naive, even wrong, to believe that all students learn best in a teacher-centered classroom. I have found myself asking "Do the students really need me to show them how to solve a linear equation (any math concept for that matter) or could they discover this on their own?" [Technology Vision Revisited, April 24, 2001]

Julia found that the course reflections helped her reach an insight about her students and active teaching methods, with regard to the student role in the classroom and the benefits to them long-term.

When Amelia and Jennifer and I were working on the PBL Group Presentation, we had three different ideas as to what was expected of us, three different propositions on how to approach it and three different thoughts on how to organize it…I remember commenting that I wanted my classwork organized for me and presented in a neat little package because the whole rest of my life consists of problem-based learning. As the semester unfolded, I became aware of how very true this was of me and the adults around me. What better way to teach my students skills for life than to engage them early in PBL! Could I really teach them anything more important? [Technology Vision Revisited, April 24, 2001]

Teacher beliefs are not easily changed, and traditional roles in the classroom can be hard to overcome (Ertmer et al., 2000; Fullan, 1993; Schrum, 1999; Van Haneghan & Stofflett, 1995). As Schrum stated, "Teachers need compelling reasons to change their practice" (1999, p. 85). In the above examples, it appears that the components of the model may be helping some teachers consider and possibly revise their beliefs with regard to classroom technology integration.

Increased Confidence, Confidence Contributors and Indicators

Post-course interviews and post-course teacher profiles (visions of technology-integrating teachers) indicated increases in confidence for five out of seven course participants with regard to classroom technology use. Contributors to this increased confidence included knowledge increase, hands-on experience, support, and feelings of accomplishment, as well as the opportunity (and willingness) to experiment with technology in the classroom.

For Kathy, the third grade teacher at Fairview, an increase in knowledge also related to her confidence in classroom technology use, as well as willingness to ask for support.

I still believe that technology is a wonderful and exciting way to teach and motivate students. I feel somewhat less overwhelmed by the amount of information and software available. I have more confidence in myself and my abilities to utilize technology. In addition, I no longer feel embarrassed to ask for help when I need it. [Technology Vision Revisited, April 24, 2001]

According to Ruth, a fourth grade teacher at Middleton, fear and lack of knowledge has been replaced by less fear, more knowledge, and a sense of accomplishment, as well as experimenting with technology in her classroom.

I have to admit, I came into this class fearful, apprehensive and knowing -- not much -- about computers or their use. Now I have to admit that I have enjoyed this work and I am definitely not as fearful about computers as I was at the beginning. I even try things and often am successful at what I try e.g. making vocabulary charts --using e- mail -- using the internet. I can even talk a little intelligently about some areas in the use of the computer. [Technology Vision Revisited, April 24, 2001]

Ruth's successes with technology use appeared to result in increased classroom technology use:

Since I'm less afraid and apprehensive I've changed my mind about computer use in the classroom too. I have learned to use the internet productively. Finding work that fits with my class especially for science. I have encouraged the students to use the internet for reports for class. I have used the computer to make charts for classroom use. I am planning to use the computer for my grading program this fall. [Technology Vision Revisited, April 24, 2001]

Peer support and accomplishment continued to contribute to confidence, as well as hands-on experience. Greta found that working with Clara and Caroline helped her confidence and her learning, as did the hands-on experience. When asked about confidence contributors, Greta answered:

Yes, and doing it with Caroline, you know…and working on our—just getting that whole page together, as I just said, it turned out marvelously because of Caroline, I think…But--cause having her-in the group, that made me be able to say, "Yeah, I can do that," you know, or "How did you do it, Caroline?"…Trying to get so that I would learn from her. [Post-Course Interview, June 4, 2001]

Kathy believed that the changes in her classroom could be attributed to her increased confidence and hands-on experience, which led to her increased technology use and experimentation.

I guess, mainly my confidence has gone up, so that created a change. And that started with the discussions and…actually getting in and using the computers, and finding new things to do with the computers myself. [Post-Course Interview, June 6, 2001]

As their technology journey continued, teacher confidence with regard to technology use increased overall, due in part to hands-on experiences, support, increased knowledge, and feelings of accomplishment. Indicators of such confidence were reflected in their encouragement of and confidence in increased student computer use and willingness to experiment with technology.

Teacher Technology Practices

Perhaps in part due to their overall increased confidence with using technology in the classroom, many teachers are trying out new ideas with regard to technology. In doing so, they are addressing challenges such as classroom organization and management, as well as time constraints.

Clara described a successful use of technology for her, one that she had only tried out that term with her students:

Each one wrote a little, um, paragraph about themselves…and then they had to find some Clip Art or something that looked…that showed--reflected them…and put it on their--their paper…and print it out. And we did get that done! So that was successful…I think because the children enjoyed it so much. They were able to follow the directions. They ended up with a good product…and they had fun. [Post-Course Interview, June 4, 6, 2001]

Clara also had her students working on researching a dinosaur project on the Internet, using the students to help each other.

What I tried to do there is put someone that was more computer-literate, someone that could read well…with someone that was a little bit lower…so they could work. So sometimes, I didn't have as many high students, so sometimes the high student would work with three or four…students at different times. [Post-Course Interview, June 4, 6, 2001]

Eleanor had her students teach her how to use KidPix, preparatory to using her technology unit, which she had developed with Kathy, the following term: In doing so, she and her students used KidPix to run ads on the VCR monitor during their Mini-Economy activity:

Um, I've kind of--we've had classes before on technology, so I was aware of a lot of this stuff, but planning our unit, we were planning on using KidPix and I had never done that before…and so I did go ahead and, um, look at it and then use it at the end of this year, so that I'll, um, be more able to jump into the unit next year.

hat was a lot of fun. And here, um, a couple of my student experts helped me cause…they had it at home and helped me how to use it and, um, so I had no idea what I was going to do with the kids, but we ended up doing, um, our ads with our Mini-Economy on there…with the--the music and the--the slide show and that--that was really cool. [Post-Course Interview, June 7 2001]

Kathy began organizing her classroom and time such that her students had greater access to and time to work on the computer.

Um, we set up a time during the day when people would have to go back. They couldn't just…you know—because sometimes some of the kids are intimidated by it, and they would…kinda say, No, I don't want to today, I'll do something else," but…we'll say, "Yes. You go." [Post-Course Interview, June 6, 2001]

As might be expected, teachers are still evolving in various aspects of technology practice. Caroline expressed concerns about assessment:

You know, I still--I was--the assessment issue is still something that--I feel better about it. I don't know that it's something I do as well as--as I could or should. Sometimes I fly by the seat of my pants. [Post-Course Interview, June 4, 6, 2001]

Greta discussed her challenges in dealing with classroom management, ensuring that all students had the opportunity to work with the computers.

I think that--yeah--the challenge is—is still how to give everyone the opportunity. How to utilize my time…The management of it. Um, this room is small…And so, my stations were never really--so they went to one station and did this, whereas in our project, the whole thing set up. So there would be four different groups or so and they would be doing different things, so that I would be working with one group…hopefully at the computer, or moving about to help some of the others, but I was hoping to make the groups such that there would be a leader type in each one, who could keep the group kind of going. [Post-Course Interview, June 4, 2001]

Conclusions and Future Implications

Impact of the Staff Development Model

It appears that the course components were (perhaps, not surprisingly) of value to different teachers in different ways. The hands-on experience, as part of the PBL technology unit, was mentioned often as being useful in terms of increased knowledge and confidence. Peer collaboration was particularly useful to those who looked to "leaders" to help them in skill building and developing web pages. Reflections were useful for "rethinking" where they were and where they are going. In some cases, reflections may have contributed, in part, to changing teacher beliefs.

Overall, the impact of the staff development model appeared helpful in terms of changing teacher beliefs and practices. Participants did not directly say, "This component helped me change my practice." However, in the sense that the various components contributed to increased knowledge and confidence, it may be termed useful. Pre-course profiles indicated that teachers vary from traditional teaching approaches toward more integrated approaches to classroom technology use (Grabe & Grabe, 1996). While further analysis is needed to confirm these initial results, this may lead to an interesting contrast relative to changes that may occur as a result of the professional development course, given the diversity of approaches.

Further Data Analysis Needs

Initial interview data with seven teachers appeared to indicate that their school cultures encourage collaboration and reflection, with some teachers also referring to other teacher "models." Given the existing culture, it will also be interesting to see how teacher beliefs and technology integration practices are facilitated by such cultures, in conjunction with (and supported by) the professional development model, which also encourages collaboration, reflection, and modeling. Further analysis is needed to confirm these impressions.

As indicated above, further analysis remains to be done on course data obtained, as well as teacher interviews and observations. While preliminary data analysis has focused on teacher beliefs, practices, and self-efficacy, as well as learning contributors, results are yet to be determined in greater depth.

With regard to efficacy data analyzed to this point, results are consistent with those of Stein and Wang (1988). While many studies have examined teacher efficacy in professional development settings, often self-efficacy is measured at one point in time (Ross, 1995). However, research has shown that teacher efficacy may be curvilinear across time (Stein & Wang, 1988). According to Stein and Wang (1988), teacher self-efficacy may increase during a professional development course, then decrease as the teacher attempts to put what was learned into practice, then later increase again as the teacher masters what was learned. It may then be useful to measure teacher self-efficacy, not only during a professional development course, but also as a follow-up (as in the following term) in the teachers' classrooms.

From the results on self-efficacy collected thus far, it appears to support Stein & Wang's (1988) conclusions. The survey instruments are currently being completed by the teacher participants (mid-term Fall 2001), and these data will contribute to the knowledge base on the curvilinearity of the results specific to teacher self-efficacy, as well as idea generation. Repeated measures data may confirm (or disconfirm) the nature of teacher efficacy across time.

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LARGE SCALE INTERVENTIONS: AN HISTORICAL CASE STUDY OF FLORIDA SCHOOLYEAR 2000

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Abstract

Throughout the ages, men and women have struggled with educating their young in the most effective and efficient ways possible. They have learned the value of education is not a unique interest of a family, community, state, or nation. Education is now embraced by a global society and serves as the equalizer for the betterment of all. *To meet this responsibility, it becomes society's challenge and opportunity to identify, design and develop interventions that provide quality education. Therefore, this research study focuses an historical case study on a large-scale intervention called Florida SchoolYear (SY2000), which was a visionary example of how the state of Florida tried to design and develop a means for delivering quality education.*

By studying the Florida SY2000 Initiative, this research study examined issue-oriented questions (e.g., impacts and influences) that confronted those individuals and groups who sponsored and advocated a large-scale reform effort designed to drive educational change in Florida K-12 schools. Conveying the research findings through an historical case study allowed the story to unfold as each informant had his/her own perspective and story to tell, from which, collectively, patterns, understandings, and recommendations were drawn.

The outcome of this research study was the presentation of SY2000 sponsors' and advocates' perceptions of what happened during SY2000, what they believed should have happened, and what they wished would happen in future education reform efforts. These individuals were selected based on their leadership or influential roles and positions held during SY2000.

Data that emerged via surveys and interviews addressed:

- *<u>Factors that affected the implementation of SY2000</u> (e.g., differing cultures, leadership, vision, buy-in, sustained commitment, and change process);*
- *<u>Costs of implementation factors</u> (e.g., research and development, allocation of resources, measurable results, time, and technology use and support); and*
- *<u>"Lessons learned"</u> (e.g., perceived effects of SY2000, obstacle of misaligned cultures, value of research and development, importance of deciding whether to redesign or recreate, criticality of having shared vision and mission, and the power of strong leadership).*

The researcher presented limitations of the research study and future research dealing with large-scale interventions. The researcher concluded this study by challenging the reader to a new way of thinking in terms of education reform (Russo-Converso, 2001).

Introduction

This historical case study focused on a large-scale intervention called Florida SchoolYear (SY2000), which was a visionary example of how the state of Florida tried to design and develop a means for delivering quality education. SY2000 was a seven-year (1989-1996) collaborative program among nine Florida districts, the Florida Department of Education, the Florida Department of Health and Rehabilitative Services, and the State University System, led by Florida State University (FSU). The purposes of SY2000 were to redesign and implement a technology-supported system of schooling. Total funding for the program, including investments made by private corporations and district "in-kind" contributions, exceeded $30 million.

The research revealed an in-depth look at how the experience of SY2000 influenced SY2000 sponsors and advocates. Respondents' stories explained what happened during SY2000, what they thought should have happened, and what they wish would happen in future reform efforts.

Therefore, the focal points of this case study centered on SY2000 sponsorship and advocacy and the "lessons learned" by those individuals having had those roles. For the sake of this study, definitions of sponsors (initial and sustaining) and advocates were based on the work of change management/leadership expert Daryl Conner and findings he presented in Managing at the Speed of Change (1992) and Leading at the Edge of Chaos (1998).

A <u>sponsor</u> is defined as an individual or group who has the authority to legitimize and power to enforce the intervention (e.g., the Florida State legislature). Sponsorship involves far more than ideas and rhetoric; it requires the ability and willingness to apply the meaningful rewards and pressure that produce desired results. Major change will not occur unless appropriate sponsors demonstrate sufficient commitment. There are two kinds of sponsors, initial and sustaining. An <u>initial sponsor</u> is defined as an individual or group who has the power to break with the status quo and sanction a significant change. An initial sponsor is usually higher in the hierarchy than those who must perform the duties of sustaining sponsors (Conner, 1992). A <u>sustaining sponsor</u> is defined as one who supports and follows through with the sponsor commitment and allocation of resources for his/her arena of influence. A sustaining sponsor has enough proximity to local targets, those individuals or groups who must actually change, to maintain focus and motivation on the change goals (e.g., Florida State Department of Education or SY2000 operational test site school superintendents). Sustaining sponsors minimize logistic, economic, or political gaps that exist between layers of the organization (education system) and produce the appropriate structure of rewards and punishments that promote achievement (Conner, 1992).

An advocate is defined as an individual or group who wants to achieve a change but lacks the power to sanction it. However, advocates are influential and valued for the advice and recommendations given to the sponsor and others (e.g., Public School Council or Policy Advisory Council). Successful advocates spend time with sponsors as they engage in remedy selling (e.g., problem solving and persuasion/communication) and pain management (e.g., dealing with resistance, barriers, and constraints). Advocates help the sponsor realize the importance of the desired change (Conner, 1992).

To understand the roles and influence of sponsors and advocates, the following assumption must be carefully analyzed: There is a tendency for those involved in or affected by a change initiative to overestimate the short-term effects of change and underestimate the long-term effects (Conner, 1992; Reigeluth & Garfinkle, 1994). The short-term effects are the results of incremental inputs and processes. The conditions for successful implementation and sustained change are greatly influenced when short-term effects are internalized and institutionalized. Change transforms into long-term effects when people are results-driven and have been given purpose and value as to why the change is required. Initial and sustained sponsorship are key to making this type of transformation/change possible. The following display (see Figure 1) is an example of a systems approach to educational reform. This operations model was created during Florida's SY2000 educational reform initiative and presents a proposed education system and related subsystems. Having no intent to show linear relationship, the subsystems are connected by a circle. The circular pattern shows connectivity or inter-relatedness among the eight subsystems (i.e., mission, curriculum, instruction, student and family services, assessment and information management, human resource development, management operations, and logistical services).

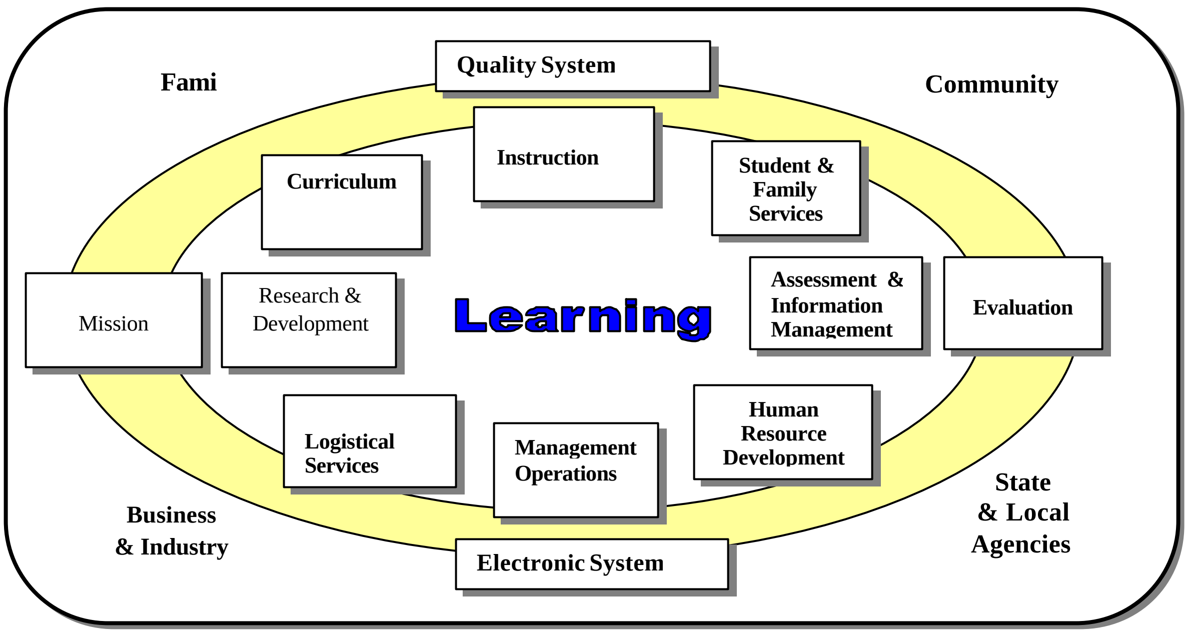

Figure 1. SchoolYear 2000 Operations Model.
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A working design team backed each SY2000 subsystem. Each design team was composed of FSU/CET design team leaders and staff, school district administrators, teachers, parents, and school community members. The design teams met on a regular basis to design and develop SY2000 interventions and products.

Depicted in each of the four corners is an external client (stakeholder – one who influences or interferes with an innovation) who is directly or indirectly affected by any change within or to the system. The circular shape forms the framework that signifies an iterative process of continuous improvement that is driven by quality and electronic systems.

The Florida SY2000 Initiative was a comprehensive attempt to change how education was being delivered and applied in the state of Florida. Based on his "upper-limit hypothesis" (Branson, 1987, 1998), Dr. Robert K. Branson, director of FSU's Center for Educational Technology and primary leader (principal investigator) of SY2000, offered the following rationale in 1987 for changing how education was currently being delivered. "As we look at the future, we in education have two paths we can consider. We could continue down our current path and experiment with a series of new educational alternatives, or we could realize that the current system might be performing at its peak and it was time to consider a new system. SchoolYear 2000 was a way of heading down that second path" (Branson, Retrieved February 17, 2001 on the World Wide Web http://cpt.fsu.edu/sy2000/WHYNEED.HTML).

Implementing SY2000 was a major change that required knowledge, skills, and resources required for moving from where the state of education was to where it should be. It was a major transition and transformation for people and processes. The greatest challenge was to sustain the change for the long journey, making a difference in the lives of tomorrow's child.

Leading change and diffusion of innovation experts highlight the critical roles of leadership and sponsorship for the successful implementation and maintenance of major change or reform efforts (Conner, 1992, 1998; Ely, 1990; Rogers, 1995; and Waterman, 1990). It is for this reason that sponsors and advocates were selected as the target audience for this historical case study research. The purpose of this study was not to judge right or wrong, true or false, significant or insignificant, but rather to offer a deeper and richer understanding of what happened, why it happened, and ultimately, what were the long-term effects of SY2000.

Factors Affecting Implementation

What does it take for an implementation to be successful? What factors cause concern if they are not implemented correctly? Many agreed that SY2000 was not strengthened when important implementation factors were not effectively executed. In this section, eight implementation factors are discussed that emerged from the SY2000 survey and interview data. Most factors aligned with Ely's (1990) conditions for successful implementation (i.e., leadership, participation – buy-in, commitment). Other factors that aligned with Ely's conditions appear in the next section as implementation costs (e.g., resources, knowledge and skills, training, time). To summarize the factors that affected the implementation of SY2000, one must consider the importance of each.

Differing cultures

There were three distinctive cultures that had initially rallied to form a synergistic partnership (i.e., government – State Legislature; university – FSU/ CET; and schools – SY2000 CSD). However, over time communication was difficult to manage among these differing cultures. Each culture was interpreting events and taking action based on its respective set of assumptions, beliefs, and behaviors. For communication to be effective, individuals and groups from each culture should have had the opportunity to learn about the others' cultures in order to reach agreement on what would be the best action for all.

From the data analyzed, I was skeptical about whether SY2000 leaders and participants understood the varying cultures from which participants or stakeholders had emerged. The data indicated that each participant seemed to have his/her respective and unique set of beliefs, assumptions, and behaviors. This was by far the mostly noted factor by respondents. It was the general belief that SY2000 did not plan for the management and education of those representing the differing cultures (e.g., government, K-12 schools, and university).

Leadership

Many change experts state that leadership is crucial to successful implementation (Ely, 1990; Conner 1992; Rogers, 1995; Lick & Kaufman, 2000). SY2000 was dependent on the capacity (willingness and ability) of its leaders to systematically design and deliver a large-scale reform initiative. SY2000 leaders had to anticipate the implications of implementation. By doing so, they would have realized the impact of clearly articulating SY2000's vision and philosophy to others. Many respondents perceived this role to articulate and communicate with sponsors in government, university, and schools as that of the SY2000 advocates. This factor was critical for identifying the assumptions, beliefs, and behaviors of differing cultures and finding ways to manage and educate their understanding and sustained commitment and buy-in for successfully implementing SY2000.

Vision

As mentioned earlier, articulation and communication of an initiative's vision, goals, and objectives is critical for participant and stakeholder buy-in. The SY2000 vision was for each student to acquire the foundational skills and competencies needed to succeed in adult life in an Information Age. SY2000 was designed as a learner-centered approach for teaching and learning. The goal of SY2000 was improving learner achievement and performance.

It is critical for participants and stakeholders to share the vision (Conner, 1990; Barker, 1993, Lick & Kaufman, 2000). The vision is the guiding star and gives purpose to the innovation. However, respondents often mentioned how the vision was not well articulated and therefore not well understood.

This factor closely related to the factors of leadership and buy-in. Respondents agreed on the criticality of a shared vision, a vision that all stakeholders understood and believed to be the goal of SY2000. When participants lost sight of the goal, strong leadership would again clear the path for them to see the vision. When participants changed (e.g., sponsors or advocates), astute leadership should have educated the new participants of the SY2000 goals and objectives and attained their buy-in and commitment. Buy-in and commitment should have been based on developing synergistic partnerships, getting people together who are willing and able to bring about change.

Sustained commitment

Buy-in, often associated with commitment, is another critical factor for successful implementation efforts (Conner, 1992; Lick & Kaufman, 2000). Buy-in must come from the participants and stakeholders of the innovation. With continuous buy-in (sustained commitment) they will develop the required capacity (willingness and ability) to achieve desired results. And with buy-in, support for the effort is provided necessary resources to achieve results – time, money, and people. Without buy-in, resistance to change flourishes and becomes a serious obstacle to successful implementation.

School districts began to question where SY2000 was headed, leading to the breakdown in dedication and commitment of school districts to SY2000. A CSD District Administrator expressed this sentiment when she said, "SY2000 should have designed incremental results built on goals. An urban superintendent's life is a little over two years. To keep a district involved and committed to the goals of SY2000, you have to create something that shows progress within short periods of time." This was the factor that means getting people to stay together through completion or achievement of goals and objectives. This is the factor that respondents perceived waned over time. Many believed that when SY2000 champions lost interest or were no longer involved, sponsorship was lost along with allocation of resources.

Communication is how one articulates and conveys a message. Communication during a change initiative is critical (Conner, 1990; Lick & Kaufman, 2000). Change participants are dealing with ambiguity and uncertainty. They are venturing into new frontiers, and with that journey comes a natural resistance to change, to thinking and doing different things. Along with strong leadership, a structure and organization has to be in place for the flow of communication to permeate all levels of participants and stakeholders. It is often said that knowledge is power. In the case of SY2000, knowledge was the foundation on which to build a powerful system for education reform.

Change process

Within the structure and organization of a reform effort, leaders must prepare the organization for change. For SY2000 to be a success, participants and stakeholders had to be prepared for the change effort. There should be a change a process for creating and managing change. Without an understanding on the part of the participants of the reform effort, over time, synergy and communication dissolves, participation wanes, and eventually interest and commitment erode. This lack of synergy and communication was an issue raised by many of the SY2000 participants surveyed and interviewed.

A CSD District Administrator explained, "The entry point for change in Florida schools is the district. Change happens school-by-school, and significant educational reform is possible district-by-district. It would be very difficult to create a rubric to measure reform outcomes at the state level, but it can be done at the district and school level. You must tie the goals of the intervention to the agreed-upon rubric."

This factor dealt with getting people to shift from "what is" to "what can be." Respondents felt sponsors or SY2000 leaders didn't recognize the "what is" to find appropriate solutions to move towards "what can be." The lack of having enough time and resources was blamed for the change process not being fully implemented.

From the people I interviewed (i.e., initial sponsors, sustaining sponsors, and advocates), I heard many times that they were eager and willing to learn and that they wished SY2000 leadership had anticipated the time and effort required for communicating and articulating the SY2000 vision and measurable outcomes. Realizing the value of implementation factors mentioned in this section, one must also understand there are costs associated with implementing change. The following section brings to light the costs that SY2000 had to anticipate, consider, and manage.

Costs of Implementing Factors

There are costs associated with successful implementation. Survey respondents (69%) agreed or strongly agreed that the sponsors of SY2000 were aware that personal, political, or system cost might be required to implement SY2000. Even though the perception was that sponsors had this understanding, the survey data showed no consensus as to whether sponsors displayed strong commitment to SY2000 - 75% of the respondents were split evenly among *agree* and *disagree*. Supporting these data were the survey and interview comments, which reflected a perception that sponsors did not manage the costs well. To summarize the cost factors for implementing SY2000, one must consider the importance of each.

Research and development

R&D are perceived as valuable inputs for any change effort. R&D identify theories, models, and current best practices associated with the design and development of a new initiative. R&D are major components of an iterative process and, as a result, are ongoing throughout the systematic design phases. Most respondents appeared to recognize the value of R&D but perceived that it was not valued by SY2000 sponsors (i.e., legislature and school districts) and should have been developed with a broader base (e.g., greater university and college input throughout the state of Florida). R&D were not highly valued by government. Politicians were under pressure to produce tangible results in the eyes of their constituents. FSU/CET was placed in a hurry-up mode to produce products to satisfy this pressure which distanced them from their expertise of R&D.

Allocation of resources

Funding was a major issue with all respondents. They realized that a large-scale education reform like SY2000 required a large sum of money and long-term support. This effort was not a tweaking of the current system, but the creation of a new way of schooling. The cost to bear was the long-term commitment of sponsors to allocate required resources – time, money, and people. Over time, the CSDs and FSU/CET resented the legislative year-to-year funding of SY2000. From the very beginning of SY2000 it was explained that it would take ten years and $100M to fully implement the proposed changes in Florida schools. Pressure mounted each year to produce tangible results in order to justify continued funding.

Measurable results

As stated in previous sections the lack of measurable results and outcomes were mentioned time and time again. Promoting an initiative's worth and value depends on the perception of its success and goes hand-in-hand with continued allocation of resources. This factor was perceived by many to be the demise of SY2000. The respondents' felt there was a lack of milestones or deliverables to justify the pressure mounting in the legislature, or to answer questions raised by CSD principals and teachers as to where SY2000 was headed.

Time

It is often said that time is a variable, not a constant, when dealing with change (Ely, 1990; Conner, 1992). Time can be shortened or lengthened on paper, but in reality it can not be tampered with without the buy-in from those who will be implementing the change. Many respondents felt time was being forced by the legislators by the pressure to produce tangible results. Others felt the university did not understand where school districts were along the change process spectrum and felt there was no time to catch up to other participants, or conversely, wait for other participants to catch up. Therefore, it was the perception of many respondents that time to implement a change initiative should not be dictated or mandated. Most respondents referred to time as a cost dependent on the demonstration of measurable results. Time was perceived as a valuable resource, but one not afforded for SY2000 to be successful.

The respondent comments demonstrate that there were many lessons to learn from having had the experience of SY2000. The next section addresses the lessons learned as described by SY2000 participants. However, the real impact will be if the lessons learned encourage the reader to reflect on these past experiences to plan and design future initiatives.

Lessons Learned

One of the greatest accomplishments in any reform endeavor is the learning that takes place. Through reflection one has an opportunity to gain insight personally (and collectively with others) about what worked, what didn't work, and what may have worked. It is from these insights that individuals or groups can create brighter visions, better plans, more effective solutions, stronger actions, and more useful evaluations for future reform efforts. Following are my interpretation of the *lessons learned* as expressed by survey and interview respondents. My interpretations are represented via the following categories:

Perceived effects of SY2000

This study was an examination of how the experience of an innovation had an affect on its participants. Therefore, survey participants were asked to state the greatest personal impact that they could directly or indirectly attribute to having had the experience of SY2000. It was surprising that many of the personal effects related to system issues or broad views (e.g., implementation factors, politics, quality systems, and strategic planning). My interpretation of these perceptions is that many of those surveyed and interviewed realized they were individuals working together within an organization (e.g., governmental, academic, corporate). Perhaps this was the reason why personal impacts were expressed in terms of wholes – education system, and not parts – the individual. Another reason why personal impacts were viewed globally may have been because of the background and experience of those surveyed and interviewed. I had contacted the perceived *movers and shakers* of SY2000 of which many continue to serve in leadership roles. These individuals tend to think "big picture" and see the spectrum of impacts of change on their respective organizations before, during, and after reform efforts. It would be interesting to examine the perceptions of those that were and remain in management or operational roles (e.g., principals, teachers, and school support personnel) to see if they too view things from a broad perspective.

Differing cultures

It is my thought based on the surveys and interviews that the most damaging obstacles for SY2000 becoming a successful large-scale reform effort were the differing cultures (i.e., government, university, and K-12 schools) that remained intact with their respective assumptions, beliefs, and behaviors. It was futurist Alvin Toffler who aptly said, "The illiterate of the 21st century will not be the one who can not read and write, but the one who can not learn, unlearn, and relearn." From the data, I believe *learning* emerged as the critical factor in getting people from differing cultures to come together, stay together, and work together.

Research and Development

SY2000 was a research-based change reform initiative. Many of the school-based and corporate (e.g., university, K-12, and corporate) respondents agreed on the importance of R&D and its role in developing SY2000 concepts and products. However, these same respondents made it clear that LSI/CET spent too much time and energy in product development when their expertise was in research and development of concepts, theories, and models. And these respondents were critical of the state legislature for not valuing R&D as they should have in terms of allocating required time and money.

Redesign or Recreate

Where do we go from here? Do we redesign or recreate? Whether reformers choose to redesign education by doing different things in the current framework or whether they choose to recreate education by doing things differently using a new framework, all agree something must be done to improve our student achievement and performance in our preK-20 education system. The respondents raised many questions based on their comments and reflections regarding wishes for education reform (see Table 1). Answering these questions is the challenge we educators have before us; although, I believe questions present an opportunity for us to design a successful large-scale reform initiative.

Table 1. Respondents' wishes and questions raised for future education reform.

Respondents' Wishes	Question Raised
Allocation of resources	How money, time, people, and training will affect the implementation of a large-scale reform effort
Creation of a systemic design	Why a systemic design should be valued as the foundation for large-scale education reform
Development of a change process	How a change process should adapt to the capacity levels (i.e., willingness and ability) of sponsors, advocates, and participating school districts and individuals
Development of a systematic design process	How a process should give organization and structure to the implementation of a large-scale reform effort
Establishment of leadership and support	Why the importance of establishing communication and articulation with and between sponsors and advocates

Table 1. continued.

Respondents' Wishes	**Question Raised**
Formation of partnering	Why the importance of establishing communication and collaboration among co-development partners
Decision for where do we go from here	Why the question of whether to redesign or recreate is raised

Many of those surveyed and interviewed gave the impression that merely redesigning what we are currently doing is not the change required to make the difference for today's and tomorrow's child. From their comments, I believe they prefer doing things differently, a primary focus was on outcomes for learning and the learner, but a secondary focus was on a change process, a process that includes and is dependent on how to make it happen.

Driving force for Education Reform

Shared Vision and Mission: For large-scale education reform to be valued and deemed imperative by sponsors, advocates, change agents, and change targets and external stakeholders (i.e., business/industry, families, community, state and local agencies) it is important for each individual/group to agree on the reasons for doing so. It is critical to share the vision and mission if change is to be successful.

The Goal of Education Reform Initiatives

2000 was designed as a learning-centered system for schools in Florida. This study's surveys and interviews with national and state leaders of education reform confirmed this premise. The true driving force of a school system is curriculum, instruction, and assessment (CIA). It is CIA from which all other education system functions serve as supports and resources.

CIA as the driving force of a school system was discussed during an interview with a CSD District Administrator. He began to draw an illustration to depict the driving force behind a school system. He drew a straight line of boxes labeled with different operational functions within a school system (e.g., Management Information Services (MIS), Legal, Finance, Student Services, Facilities, Personnel, and Human Resource Development (HRD). The administrator explained that most school, district, community, state, and public attention and resources are spent on these operational or functional supports. In contrast, in his 30+ years of service to public education, he believes the attention and resources must be spent on the true driving force of a school system, the curriculum, instruction, and assessment (CIA). He said research and development provide inputs to CIA, and CIA serves as the direct path to the teacher and student, for it is CIA that directly impacts student learning, achievement, and performance. I began to share my thoughts and ideas and together we developed the following CIA driven school system model (see Figure 2).

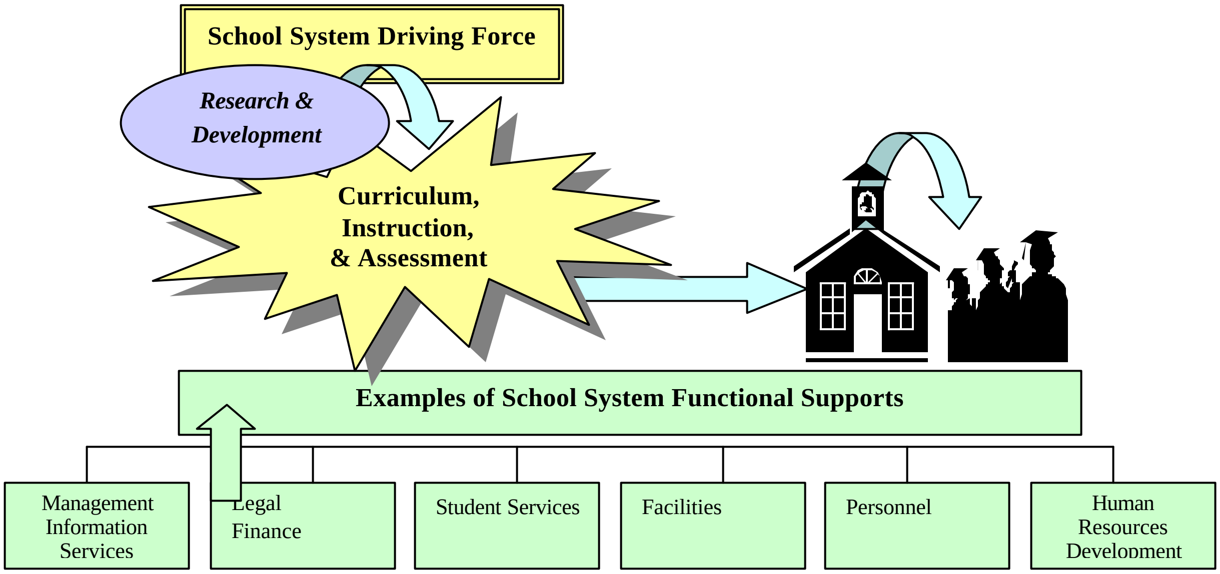

Figure 2. Driving force behind a school system: Curriculum, instruction, & assessment.

Leadership

Finally, I will close this section on lessons learned by addressing what I feel is the most critical component of any organization undergoing a change effort, leadership. From the literature review, the interviews conducted during this study, and the years of experience in public school education, I have learned that collaboration among participants of a change effort cannot be derived, but rather is built over time. One can bring players together, but it is ultimately the players who will decide if, when, and how they will work together. I have developed a model of leadership for education reform (see Figure 3).

The first step is getting participants to sit at the table. Implementing change takes a unique leader with leadership capacity (i.e., willingness and ability) to orchestrate a team of players (e.g., thinkers, visionaries, planners, designers, developers, implementers, and evaluators). For this type of leader to be effective he/she must actively involve the participants from the very beginning and sustain their involvement throughout the diffusion of the innovation to its attainment or completion. And finally, education reform requires resources (e.g., time, money, and political finesse). These resources are developed with partnerships with the state legislature, schools, universities, and business and industry and others. These individuals or groups are considered the stakeholders because they will directly or indirectly benefit from the success of the reform.

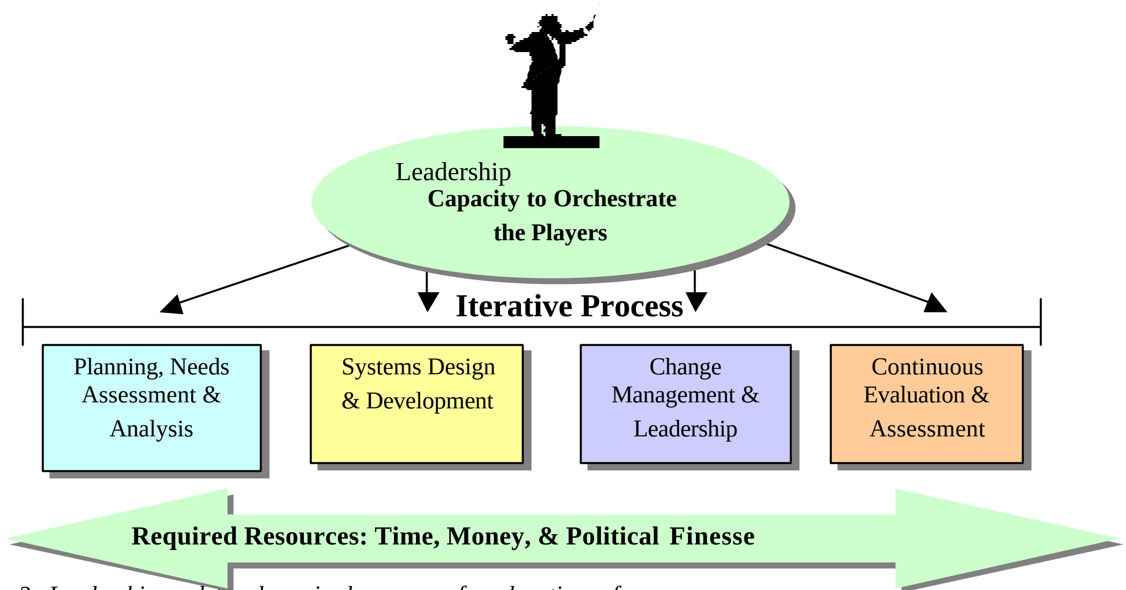

Figure 3. Leadership model and required resources for education reform.

So what can be concluded about SY2000? Many believed SY2000 was merely ahead of its time. Following are comments reflecting this perception. A former State of Florida Education Officer said, "SY2000 left an impact. SY2000 was the beginning of *The Change* and it got the rhetoric to the future change. It was a catalyst for Florida to bring about change. SY2000 never died: its funding was terminated. SY2000 was a flag for *'Here is Education Reform'*. I believe SY2000 was the kick start for education reform; however, it got politicized, and funding was eventually terminated."

Conclusion

What lies ahead for education reform? Does education need merely reform or an entire re-creation? Has the shift from teaching to learning-centered education created a purpose for change? Has technology brought new ideas and opportunities for teaching and learning, as we have never seen before? These changes result in paradigms, therefore what are the solutions for these new paradigms? And what change is required to align education with these new mindsets and directions?

Summary

The outcome of this research study was the presentation of SY2000 sponsors' and advocates' perceptions of what happened during SY2000, what they thought should have happened, and what they wished would happen in future education reform efforts. These individuals were selected based on their leadership or influential roles and positions held during SY2000.

What were the successes of SY2000? I believe SY2000 participants understood the value of a systemic approach to educational reform. There were none whom I surveyed or interviewed that questioned a system design for education reform. On many occasions I heard that SY2000 was brilliantly conceptualized and designed. From all that I heard and read, I believe SY2000 opened many minds to view education as a system comprised of subsystems and mere "tweaking" of subsystems would not make for sustained change or reform.

Another success of SY2000 was the introduction to change management concepts and principles. Many agreed that change was a process, not an event. It was believed that moving from the status quo to the ideal vision required strategic and tactical operations. Respondents welcomed what they were learning about change and how and why people make the transition from "what is" to "what should be."

However, with success of SY2000 came failures. The failures of SY2000 were often missed opportunities or lack of understanding or expertise to anticipate possible outcomes. SY2000 leaders underestimated the significance of vision, buy-in and sustained commitment for SY2000 to be deemed successful. Over time, if those involved were not continuously educated to where they were in the change process, interest and commitment faltered, and was eventually lost. This was the case with sponsors, advocates, and CSD participants.

Legislators should have better realized the value of time and research and development as resources for embarking on a massive and complex reform effort such as SY2000. One can't expect results of an unfinished research-based intervention. However, SY2000 should have built in incremental successes or measurable results that could have been perceived by sponsors and advocates as successes to gain and sustain buy-in and commitment.

Without doubt, SY2000 should have better developed the required synergistic partnerships among the differing cultures. From hearing the different perspectives of government, K-12, and university respondents, I find this to be the main demise of

SY2000. Education of these individuals and groups was crucial for vision, buy-in, and commitment. I believe all three shared the vision of SY2000, however I question whether they shared an agreement on how it was to be achieved and measured.

And probably the greatest lesson learned from these successes and failures or missed opportunities was realizing the importance that learning must precede change. This learning is the cornerstone or bedrock for getting people to come together, work together, and stay together. Learning depends on open communication and collaboration. Both are built on developing trust to solve problems together and having respect for the power of the whole being greater than the sum of its parts.

Limitations of this Research Study

There were two key limitations to this research study: time and resources. There was not enough time to explore the relationships between other SY2000 change participants and sponsors and advocates (i.e., change agents - CET design team leaders and participants, school principals, district staff; and change targets - SY2000 teachers, instructional support staff, students, and families).

In addition, there was not enough time, travel funds, or political clout to gain access to (or obtain the inputs of or feedback from) Florida State Senators or State and DOE Commissioners of Education who were in office during the SY2000 years. The lack of time also limited the breadth and depth of this study to obtain a broader and sharper image. I would have liked to pursue making contact with some of the individuals who did not respond to mail, email, or telephone requests. I believe due to current sensitive issues regarding politics and education issues (e.g., vouchers, charter schools, accountability, and testing/assessment, university and college restructuring, and skeptical public perception of education in general), I would have had to secure others' support to gain access to some individuals.

Future Research in This Field

Future research in the field of large-scale education reform should investigate the role of change management and change creation in the diffusion of an education innovation or initiative. Action research should validate systematically planned, designed, developed, implemented, and evaluated reform efforts that are based on the change frameworks and methodologies outlined by Conner (1992), Lick and Kaufman (2000), and Ely (1996). In addition, future research should investigate the role and impact of leadership during diffusion of an innovation in an educational setting (e.g., knowing whom to turn to for support and resources – information, time, money, people). I suggest further study to find ways to eliminate communication voids when revolving sponsorship is inevitable.

I suggest further research to validate Lick's *Universal Change Principle*, learning (both as a verb and noun) must precede change, by applying it to the diffusion of an implementation and evaluating it in terms of cost and benefit value. Such a research study could examine and validate ways to educate sponsors, advocates, change agents, change targets, and stakeholders on the strategic and tactical approaches to change creation and implementation (Conner, 1992; Lick & Kaufman, 2000).

Finally, future research should consider an in-depth examination of the impacts from a large-scale education reform on other key change roles, the change agents (e.g., innovation design team leaders and participants, school principals, district staff) and change targets (e.g., teachers, instructional support staff, students, and families).

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The Impact of Mobile Computers in the Classroom – Results From an Ongoing Video Study

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Abstract

Since the early 1990's, laptop computers have repeatedly been suggested as a tool to improve instruction and student learning. Meanwhile, several evaluations have shown that laptops helped to increase the amount of independent and collaborative learning. Instruction with laptops was also found to be more student-centered in many cases. However, most of these studies are based on subjective data (interviews and questionnaires) exclusively. Observational data to confirm these findings is missing. The present study examines 45 lessons (24 with and 21 without laptop use) that where videotaped over the course of 2 ½ years in a laptop program of a German high school. It is found that when laptops are used, the use of other instructional media, particularly notebooks and the blackboard, decreases significantly. The amount of independent work is found to increase significantly, while for other forms of instruction, such as teamwork, pair work, lectures and teacher-guided discussions no differences can be determined. The results are discussed in relation to interview and survey data gathered in the same study.

Introduction

Many studies have shown that computers at school can have a beneficial effect not only on student achievement but also on students' learning motivation, on classroom atmosphere, and on the teachers' willingness to experiment with new and innovative instructional approaches (Christmann, Badgett & Lucking, 1997; Dwyer, 1994; Kulik & Kulik, 1991; Liao, 1992; Losak & MacFarland, 1994; Sivin-Kachala & Bialo, 1996). Yet, it is often lamented that schools are reluctant and slow in integrating computers and in adapting to the needs of the information society (e. g. Peck & Dorricott, 1994). Studies found that the schools' computer equipment is often used inadequately or not at all (Marcinkiewicz, 1993). One reason for this might be that most school computers are desktop machines located in computer labs, which cannot be used flexibly when needed and cannot be used outside school (Fabry & Higgs, 1997). Obviously, in an arrangement like this, computers cannot become the natural tool for learning that is so often called for.

The use of mobile computers is often suggested as a possibility to solve this problem. Only if every student and every teacher had his/her own laptop computer, say proponents of mobile computers, information technology in education could be used to its full effect. Therefore, the introduction of laptops to the classroom is seen as a major catalyst for a profound change in learning and instruction in K-12 as well as in higher education (Owen & Lambert, 1996; Robertson, Calder, Fung, Jones & O'Shea, 1997; Stager, 1995).

Since the start of the Microsoft „Anytime, Anywhere Learning" initiative in 1996 (to name only one of numerous sponsoring programs), the use of mobile computers has spread worldwide and several extensive evaluations have been carried out (e. g. Bruck, et al., 1998; Fouts & Stuen, 1997; Hill & Reeves, 1999; Rockman et al., 1998; Stevenson, 1999). With regard to instructional strategies and classroom practice, some of these studies found that phases of independent work as well as project work increased (Fouts & Stuen, 1997; Rockman et al. 1998) or that teachers felt that laptops were particularly suited to this kind of work (Bruck et al., 1998). Studies also repeatedly showed that there was more extensive collaborative learning in the laptop classrooms (Bruck et al., 1998; Fouts & Stuen, 1997; Rockman et al. 1998) and that students liked to help each other as well as their teachers with laptop problems (Bruck et al., 1998; Rockmann et al., 1998). On the other hand, it was also found that technical problems often hampered the successful use of laptops in the classroom (Bruck et al., 1998; Robertson et al., 1996, Rockman et al., 1997). In addition, Bruck et al. (1998) reported that some teachers deplored a high level of student distraction, as well as the loss of authority and control in the laptop classroom.

Overall, it seems that many of the positive expectations that are associated with the use of mobile computers in school could be confirmed in recent studies. However, the studies referred to above are tainted with various problems: First, the results are mainly based on questionnaire and interview data exclusively, which is known to be biased in several ways (Bortz & Döring, 1995). Behavioral and observational data to confirm the self reported data is missing in most studies. Also, many studies did not investigate control groups so that the effect of the laptop computers is not clear. Finally, results are sometimes based on rather short observation periods (ranging from a couple of weeks to 2 years at most) and small student samples.

Background of the study

In March 1999, one of the first laptop programs in Germany started at the Evangelisch Stiftisches Gymnasium Guetersloh. More than 300 students of this high school and their teachers were gradually furnished with networked laptop computers. Students of four cohorts entered the program in grade 7 and are using laptops regularly at school and at home until the end of grade 10.

The school's administrators, participating teachers and parents have developed an elaborate pedagogical concept for the integration of laptops, which is based on the school's three general assumptions about the benefits of incorporating media in instruction: Media are essential to foster students' media literacy, they can serve as a tool to connect the classroom to the authentic world outside school and they are a valuable means to improve instruction (Engelen, 2000; 2001a, b). With regard to the improvement of instruction, the concept draws from a reform-pedagogical framework that states that media should be used to

- foster the concreteness and vividness of instruction,
- facilitate individualized learning and intensify phases of student work
- strengthen teamwork and communication in the classroom
- increase the amount of independent learning and problem solving
- further students' responsibility and improve their attitude toward co-operation and sense of belonging to the school community

This framework provides the foundation for the school's concept of laptop learning. Teachers jointly develop instructional units based on these reform-pedagogical ideas, making sure that the computers are used to serve a sound didactic purpose. Important cornerstones of the concept are also that the computer is integrated into the regular curriculum from the very beginning and that the frequency of use of the laptops is increased step-by-step, starting with only one subject and gradually expanding to the whole curriculum within the first project year.

An extensive evaluation that is carried out by the Center for Media Research, Freie Universitaet Berlin accompanies the pilot project. The evaluation focuses on changes in instructional strategies and classroom practice, student achievement in selected subject areas and the acquisition of cross-curricular competencies (an extensive report will be published in 2002 by the Bertelsmann Foundation, one of the main sponsors of the project). This paper presents preliminary results regarding the first aspect, instructional strategies and classroom practice.

Method

To overcome the shortcomings of other studies pointed out above, observational data was gathered to investigate changes of teaching strategies and classroom practice. A randomly selected sample of lessons of the laptop classes was videotaped over the past 2½ years. The same classes and the same teachers were recorded repeatedly. As the laptop classes are not using their computers every day, lessons with and without laptop use could be recorded in the same classes with the same teachers. Confounding effects that result from comparing different classes or teachers with different teacher styles, could thus be reduced. Subjects covered are mathematics, German, and English.

A body of 45 lessons was videotaped. 24 of these were laptop lessons, 21 were lessons without laptop use. Table 1 provides an overview of the distribution of lessons.

Table 1: Distribution of lessons with and without laptops

			Grade			Total
Laptop			Grade 7	Grade 8	Grade 9	
With Laptop	Subject	English	4	3	1	8
		German	5	4	1	10
		Maths	3	2	1	6
	Total		12	9	3	24
Without Laptop	Subject	English	4	1	-	5
		German	5	3	1	9
		Maths	2	3	2	7
	Total		11	7	3	21

The lessons with and without laptops have so far been compared for use of instructional media and form of instruction. Every lesson was divided into a maximum of nine intervals of 5 minutes length. For each interval, two trained observers recorded the dominant media use and form of instruction. The inter-rater agreement, as determined with the intra-class coefficient, was .93 for the use of instructional media and .79 for the form of instruction.

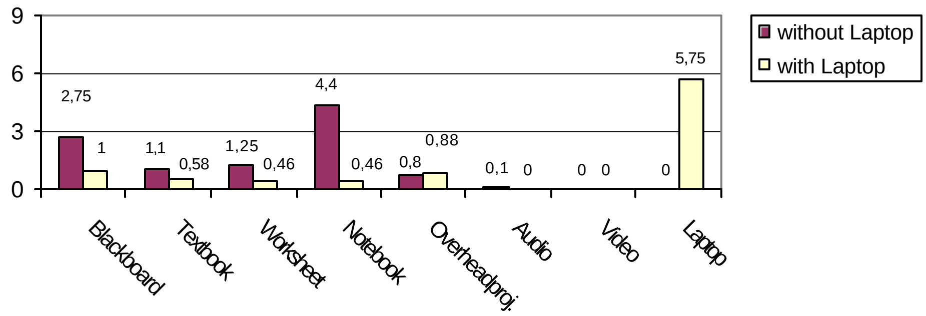
The results of the video study are discussed in the light of data gathered from student surveys and qualitative interviews with teachers and students in the last section of this paper.

Results

Use of Instructional Media

On a descriptive basis, it was found that the use of the laptop had a decreasing effect on the frequency of use of "traditional" instructional media, such as textbook and worksheets, blackboard and notebooks (see Fig. 1).

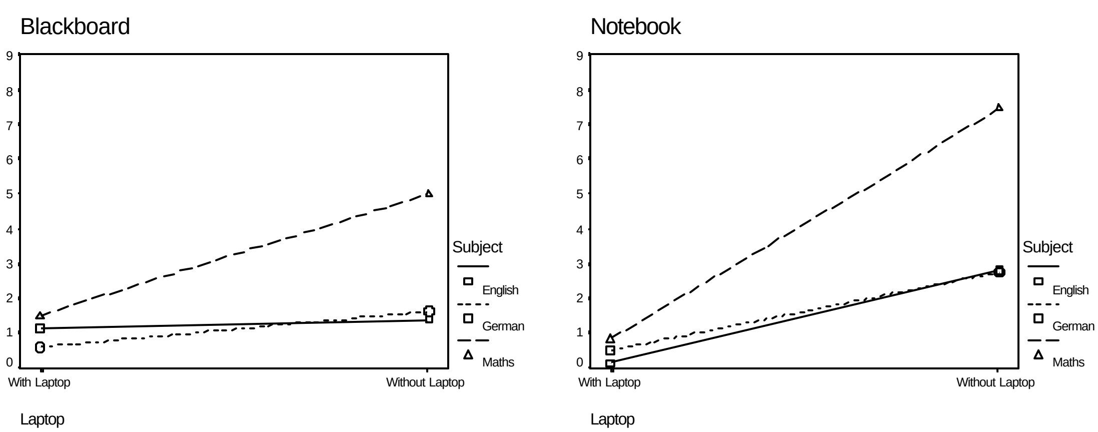
Fig. 1: Media use (number of 5-minute intervals) in lessons with and without laptops



The difference between laptop and non-laptop lessons was tested with a multivariate two-factorial analysis of variance with laptop use and school subject as fixed factors. The dependent variables were the frequencies of instructional media use. A significant main effect was found for the factor laptop use (Wilks's Lambda = .10; $F(7,32) = 40.04$; $p < .01$). An analysis at the univariate level showed that the frequency of use of the blackboard ($F(1,38) = 9.62$; $p = .04$), notebook ($F(1,38) = 52.37$; $p < .01$) and of course laptop ($F(1,38) = 214.48$; $p < .01$) was significantly different between laptop and non-laptop lessons. The frequency of use of worksheets tended to be significant ($F(1,38) = 3.72$; $p = .06$).

The interaction of laptop use and school subject tended to be significant at the multivariate level (Wilks's Lambda = .53; $F(14,64) = 1.69$; $p = .08$). A subsequent univariate test indicated that there was a significant interaction for the use of the blackboard ($F(2,38) = 3.32$; $p = .05$) and notebook ($F(2,38) = 6.60$; $p = .03$). The interaction plot is depicted in Fig. 2. It can be seen that there is a particularly sharp decrease in the use of the blackboard and of notebooks in mathematics, while the difference is much less distinct in the two other subjects.

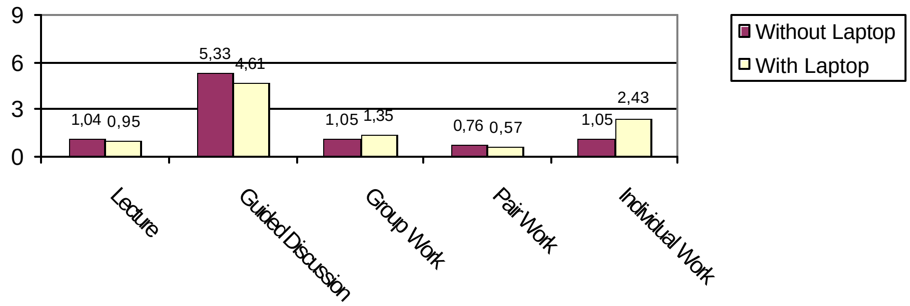
Fig. 2: Interaction plots for blackboard and notebook



Form of Instruction

For the form of instruction, the descriptive analysis showed that guided discussions are the most prominent form of instructional activity both in laptop as well as in non-laptop lessons (see Fig 3). Laptop lessons differed most strongly from non-laptop lessons in that students work individually more frequently. Qualitatively, it was interesting to note that phases of individual work were often longer when the laptop was used than in non-laptop lessons. Group activities were also observed slightly more often in laptop lessons than in non-laptop lessons and tended to be more project-based, while group activities in traditional lessons were shorter exercises that could be solved in a limited amount of time, typically within the respective lesson. The frequency of lecture and pair work is almost identical in laptop and non-laptop lessons.

Fig. 3: Form of instruction (number of 5-minute intervals) in lessons with and without laptops



The difference between lessons with and without laptop use was again tested with a two-factorial analysis of variance with laptop use and school subject as fixed factors and the five forms of instruction as dependent variables. A significant main effect was found for the factor laptop use (Wilks's Lambda = .71; $F(5,34) = 2.82$; $p = .03$). At the univariate level, only the frequency of individual work was found to be significant ($F(1,38) = 10.82$; $p < .01$) while the other differences could not be statistically confirmed. The interaction of laptop use and school subject was not significant (Wilks's Lambda = .73; $F(10,68) = 1.16$; $p = .33$).

Discussion

The differences in the use of instructional media in laptop and non-laptop lessons show that the computer primarily takes over the function of the notebook. This finding corresponds with the statement of students and teachers in questionnaires and interviews that the laptops are most frequently used as a writing tool. However, this does not mean that the laptops are simply used as an "electronic notebook". In fact, especially in the teacher interviews it is emphasized that using an electronic writing tool enhances the use of the traditional notebooks in several ways: Most importantly, the possibility to easily change and edit text is seen as a tremendous advantage of the laptops for introducing students to the process of writing. It helps to encourage them to critically analyze their own and their classmates' texts and improve them by revising and re-writing them multiple times. Also, some teachers say that writing electronically motivates reluctant writers and many students stated that writing with the laptops was fun and one of their favorite activities. In addition, the laptops are used to create archives for certain subject matter (e. g. an English grammar archive or a Mathematics archive) with entries that are electronically linked. These archives are continually expanded throughout the years. Both, teachers and students said that the archives have many advantages in comparison to traditional notebooks, as they have a more transparent structure, new entries can easily be connected to existing entries, they do not get lost and some students found that they are better suited for revision and learning. Finally, teachers and students stated that co-operative writing tasks could be carried out much easier with computers.

Another remarkable difference in the use of instructional media is that the blackboard was used less often in laptop than in non-laptop lessons. This may indicate that instruction in the laptop lessons is less teacher-centered as the blackboard is typically used in teacher-guided phases. The teacher interviews confirm this interpretation as teachers said that when they teach with laptops they often do not teach the whole class but interact with individual students while the class is working on a problem individually or in groups. However, the analysis of the frequency of lectures and teacher-led discussions in laptop and non-laptop lessons weakens this assertion (see below).

Regarding the school subjects, the clearest difference in the use of instructional media was found in mathematics. Mathematics was found to be the subject that makes most extensive use of the traditional media notebook and blackboard in non-laptop lessons. Thus, in terms of instructional media use, it is impacted most profoundly. However, subjectively, the change is felt similarly in all subjects, as the observations from the interviews referred to above were comparable across subjects.

Regarding the form of instruction, the differences between lessons with and without laptop use are less clear. Phases of individual work increased. This corresponds to the pedagogical concept of the school on the one hand, as the laptops were to be used to facilitate individualized learning and intensify phases of student work and to increase the amount of independent learning and problem solving. It also confirms the statement of the teachers in teacher interviews that they use the laptops to activate the students and often employ them for individual work to make sure that every student acquires computer literacy, which is one of the main goals of the project.

The frequency of teacher-led discussion decreased in laptop lessons. However, the difference in comparison to non-laptop lessons was not significant. This difference was felt to be much stronger in the teacher interviews, where a majority of teachers stated that instruction is becoming considerably less teacher-centered when laptops are used. The video observation shows that just like in traditional lessons, guided class discussions are still the most prominent form of instruction in laptop lessons. Also, the amount of lectures was almost identical in laptop and non-laptop lessons.

Moreover, the frequency of group work did not differ strongly between laptop and non-laptop lessons. This result is partly confirmed by student surveys as two of the three cohorts reported only a slight increase of group work or even a decrease of group work. Teachers held varied opinions on whether they had students do more group work when laptops were used. Especially some teachers of the first cohort experimented extensively with teamwork and carried out several student projects. Experiences were mixed, as students were partly overwhelmed when they worked on projects in multiple subjects at the same time. In the following years, project work was therefore reduced. Some teachers of the second and third cohort reported that they do not use group work more often than in regular instruction. Yet, students as well as teachers unanimously reported that they felt that laptops are a valuable tool for teamwork and that working collaboratively is easier with laptops than with traditional media.

Conclusion

The results show that the major change in the laptop classroom is an increase in individual work. Students work more often independently, which according to many teachers, results in a higher degree of activation than in traditional lessons. In contrast to other evaluations mentioned earlier, this study could not unequivocally confirm that using laptops led to more collaborative classroom activities. Even though strengthening teamwork and communication in the classroom is one of the declared pedagogical goals of the project, there was no clear general increase in group work. It seems that while extensive group projects have been carried out with the laptops, this was rather the exception than the rule. If only subjective data had been gathered, these projects could have easily been overemphasized. The same is true for the change from teacher- to student-centered instruction. While there are clear indications that the laptop classroom is becoming more student-centered, the video analysis also shows that the change is less profound than only looking at the subjective data might have suggested.

The use of video proves to be a helpful tool to corroborate findings that are based on subjective data. Results, which were derived from questionnaires and interviews, could be confirmed through observation in many cases, thus raising their credibility. While it should not be concluded that one source of data has more value than the other, this study shows that combining observational and survey/interview data is worthwhile to enhance the validity of a study's results. It reduces the danger of misinterpreting findings and helps to detect possible biases in subjective reports.

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AECT Advanced Program Standards and Web-Based Portfolio Development

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Abstract

An instructional approach for conceptualizing the five domains of the instructional technology knowledge base defined by AECT Initial and Advanced Program Guidelines —design, development, utilization, management and assessment—that were required to be integrated into professional electronic portfolios developed by educational technology degree candidates is examined. An in depth look of the process is provided through quantitative and qualitative data about the students' perceptions of the utility of the AECT domains for communicating their professionalism in their portfolios. The process is further examined through the lenses provided by five departmental faculty members' qualitative assessments of the students' portfolios and the students' presentations of these artifacts. Results of this preliminary study indicate that although the five domains tend to be valued for their usefulness in designing to express emerging professionalism, unless required, most would not employ them. Once applied, however, most would retain this framework. Additional suggestions for modifying the portfolio design and development process from initiation in a web-based course towards the beginning of the students' course of studies through to the final presentation at the conclusion of their program are offered. The increased emphasis on portfolio development throughout education, the growth of web-based design, and the acceptance of the AECT Guidelines for candidates in both Basic Media Technology in Teacher Education and Advanced Programs in Educational Communications and Technology by the Council for the Accreditation of Teacher Education (NCATE) suggest continued study. Such study is especially warranted in terms of the potential for providing learner guidance relative to this area for students enrolled in educational technology programs.

Introduction

The Accreditation Committee of Association for Educational Communications and Technology (AECT) provides Folio Review Guidelines related to educational technology. The guidelines include Basic Guidelines for Media Technology in Teacher Education, as well as for Advanced Programs in Educational Communications and Technology (Association for Educational Communications and Technology, 2000) that are accepted by the National Council for the Accreditation of Teacher Education (NCATE). These guidelines provide a systematic means for internal and external program reviews at colleges and universities throughout the United States.

Standards in Education

In this twenty-first century such an emphasis on standards for education is not uncommon. Examples can be found relative to overall professionalism for teachers (National Board for Professional Teaching Standards, 2001), specific Standards for Technology in Teacher Preparation (International Society for Technology in Education, 2001), and specific content areas, such as standards for mathematics (National Council for the Teachers of Mathematics, n.d.).

Standards in Educational Technology

In the field of educational technology, candidates in both entry level and advanced programs are expected to acquire knowledge and skill within five main areas of the instructional technology knowledge base in domains of: design, development, utilization, management and assessment. Within advanced programs, candidates should demonstrate minimal competencies within each area along with advanced capability in aspects specifically emphasized by the program at their institutions.

Web-Based Delivery of Instruction and Professional Portfolio Development.

Additionally, two other areas that impact educational technology majors are web-based delivery of instruction and professional portfolio development. These students may acquire some of their capabilities through web-based coursework. Educational technology majors, as current and future teachers or trainers, may be expected to teach by means of the World Wide Web (WWW). Experience with this mode of learning is essential for their future distance learners and for their colleagues when they function as consultants. Furthermore, these majors are increasingly expected to demonstrate their knowledge and skills at the completion of their program of studies in electronic portfolios.

Professional Electronic Portfolios

Professional electronic portfolios would appear to be an integral part of the core concepts of post-modernism that Solomon (2000) relates to instructional technology. Professional portfolio development supports: 1) respect for differences and multiple explanations through inherent nonlinear design; 2) construction of personal views by prospective employers and others through text, audio, and visual information about the candidate; 3) critical evaluation as candidates assess themselves at the design phase; and 4) expression, to some extent, of the complexity of the system of educational technology as hypermedia links to design, development, utilization, management, and evaluation aspects and to candidates' professionalism and theoretical constructs of the field. Additionally, development of Web-based electronic portfolios is growing at all levels of education (Sanders, 2000).

Web-Based Course, Program of Studies, and Web-Based Production

At a department of educational technology at one Pacific-based university, graduate students participate in a totally Web-based course on newer technologies. Typically, they enroll in this course in their first or second semester in the program. The Web-based delivery mode of this course with its multilevel, hypertext structure and design for interactivity with the learners by synchronous and asynchronous communications, text, audio, and graphic display (Chu 2000) offers a supportive context for core concepts of postmodernism.

Along with earning 39 graduate level credits in required and elective courses, completing 6 credits in prerequisite courses, engaging in both a collaborative and individual practicum, and carrying out a comprehensive master's project, these students were recently required to also produce a professional electronic portfolio during their program of studies. Introduction to this portfolio process was incorporated in the required Web-based course that addresses basic concepts of instructional design and multimedia authoring. Typically, students enroll in this course during their first or second semester of study. In following this newer departmental process for developing this Web-based multimedia perspective about themselves, they continue the process throughout their program. As currently designed, after the initial course, consultation with peers and advisors about their continued development of their portfolios occurs primarily when initiated by the student. During a culminating course, they do have the opportunity to critique each other's work prior to formally presenting their completed portfolios to the faculty.

When this project was first instituted, students studied multimedia design principles (Park and Hannafin, 1993) and addressed general guidelines for content broadly described to encourage individuality of expression. At the conclusion of the course, initial portfolios were assessed in terms of effective design and plan for content coverage. An initial investigation of the students' work indicated that, although they demonstrated competencies in all five domains that define an educational technologist, they did not tend to overtly conceptualize their expertise within this framework. Many communicated their capabilities in terms of courses, which may or may not be meaningful to future employers (Sherry, 2000).

Problem Statement

Although faculty in educational technology programs, particularly those members engaged in the NCATE process, may become adept at describing their programs and their candidates' capabilities in terms of these domains, how might their students begin to conceptualize their leaning within this framework? Presenting their competencies in this manner could offer potential employers and their graduate faculty a consistent, professional view of their expertise in these critical areas in relation to standards set by a professional association.

As these findings emerged, departmental faculty members decided to disseminate information about the domains and the framework for the portfolios as the students were developing their initial portfolios in the Web-based course. They followed up with a print-based reminder as the students advanced toward completion of their portfolios prior to graduation. These students earn the required minimum of 39 credits in courses in areas specific to these domains and in specific related aspects of educational technology. As students who are used to developing and analyzing instructional designs in a structured manner, it became essential to evaluate their perceptions of the utility of, and type of integration of, this structured framework for expressing their nascent professionalism.

Methodology

An investigation was, thus, undertaken as a preliminary evaluation study.

Ethical Practice and Participants

This examination, construed as standard educational practice, received the anticipated exempt classification after review by the Institutional Review Board Committee for the Protection of Human Subjects at the university where the study was conducted. In compliance with that process, all participants were fully apprised in writing of the nature of the study, their option for voluntary participation, and their option to participate in having examples of their work displayed as results of the study were disseminated. Of the eight students who completed portfolios prior to graduation, seven agreed to participate in the study. The resulting 88% return rate, represents five of the six females and both of the males; an acceptable rate to provide an initial perspective of the perceived usefulness of the five domains for communicating professionalism as educational technologists through the medium of electronic portfolios.

Data Gathering

Data are based on quantitative and qualitative responses from, and the actual portfolios created by, participants and on qualitative data from their faculty members.

Survey Instrument.

As no published survey was identified that addressed the questions being studied, a written survey was developed. Questions designed to capture demographic data about gender, employment, planned portfolio usage, experience producing portfolios prior to creating these professional portfolios, and awareness of the five domains of an educational technologist were included in the survey. The students' views of the usefulness of the five domains were operationalized in terms of five constructs. The five are the utility of employing the domains in their portfolios for communicating: 1) the students' knowledge, 2) the students' skills, 3) the range of the students' professionalism, 4) the contribution the domains made to the students' descriptions, and 5) the students' intent to retain the domains in their portfolios after graduation. Their reactions to these five aspects were captured on a ten item survey that has a negatively and positively worded item for each aspect.

The Loyd and Gressard (1986) Computer Attitude Survey consisting of 40 positively and negatively worded items about attitudes toward computers served to guide the construction of these types of questions. For example, the two items about perceptions of skills appear as, "The 5 domains are useful in my electronic portfolio in describing my <u>skills</u> in the field of educational technology" and "My <u>skills</u> can be described better if descriptors other than the five domains are used." A graduate student in the program also offered one-on-one feedback about the survey during its construction.

Students indicated their degree of agreement on a four point Likert-like scale that ranged from "strongly agree" to "strongly disagree". In addition, five open-ended questions were developed to obtain input about the type of examples that students' selected for their portfolios when expressing their performances in each of the five domains of an educational technologist. A final broad, open-ended question sought additional comments.

<u>Artifacts</u>.

The students' electronic portfolios also served as a means of verifying application of the domains.

<u>Faculty Responses</u>.

The five full-time departmental faculty members also provided oral input after viewing the students' formal presentations of their portfolios. The relatively small size of the department (5 full-time faculty members and c. 50 master's degree candidates) did not permit the separation of the investigator as a participant.

Data Analysis

During analysis, an emphasis on the more objective data—the quantitative responses from the students—and validation of the faculty members' judgements expressed as emergent themes about the students' portfolios and presentations were confirmed by all the faculty members. This approach was taken to mitigate to some degree any potential for bias that might occur from the close association between the primary investigator and resulting interpretations of the data. Despite the small numbers of participants, the multiple sources of data collected in this study do have potential to offer an initial view of a process that others may wish to employ to some degree as they engage in similar efforts.

<u>Quantitative Data</u>

Quantitative data were analyzed in terms of frequency distributions. From those analyses the picture that appears shows that among the seven respondents who provided usable data, two were unemployed prior to graduation, four were working as graduate assistants in a technology support capacity, and one was employed in a network security role. Five had had no experience producing any type of portfolio prior to initiating work on their professional electronic portfolios for their master's program. All of the participants indicated that they only become aware of the five domains of an educational technologist as they completed their electronic portfolios.

To more readily express the sentiments of the limited number of participants, the "strongly" and "slightly" agree categories for both agreement and disagreement were collapsed into two categories of agreement and disagreement.

As indicated in Figure 1, the five domains are viewed as contributing to the communication of knowledge and skills as an educational technologist by six of the seven respondents for the former aspect and all of the students for the latter one.

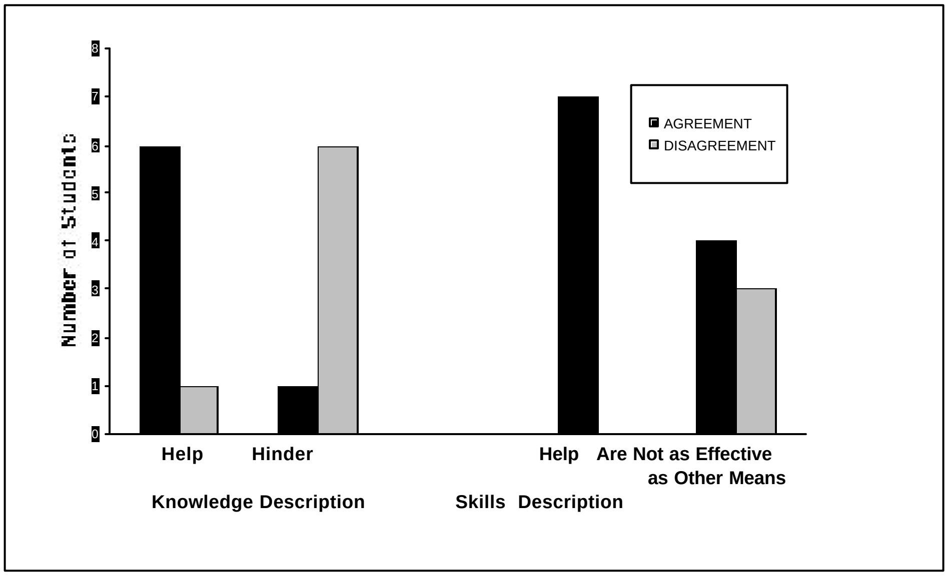

Figure 1. Perceptions of the usefulness of the five domains of an educational technologist when conceptualizing professionalism as an educational technologist in a professional electronic portfolio.

Despite the positive regard for applying the domains to describe skills, negativity predominates (n=4) in regard to the domains being used for skill description rather than some other means.

Figure 2 reflects students' responses to the picture of the domains, and the perceived contribution to professionalism, as well as, to confusion during use. For expressing overall professionalism, all but one of the respondents view the domains as being helpful and not hindering such a depiction. Most (n=5) view the domains as contributing to depicting their range of capabilities. The same number, however, do agree that during production the domains are confusing to use.

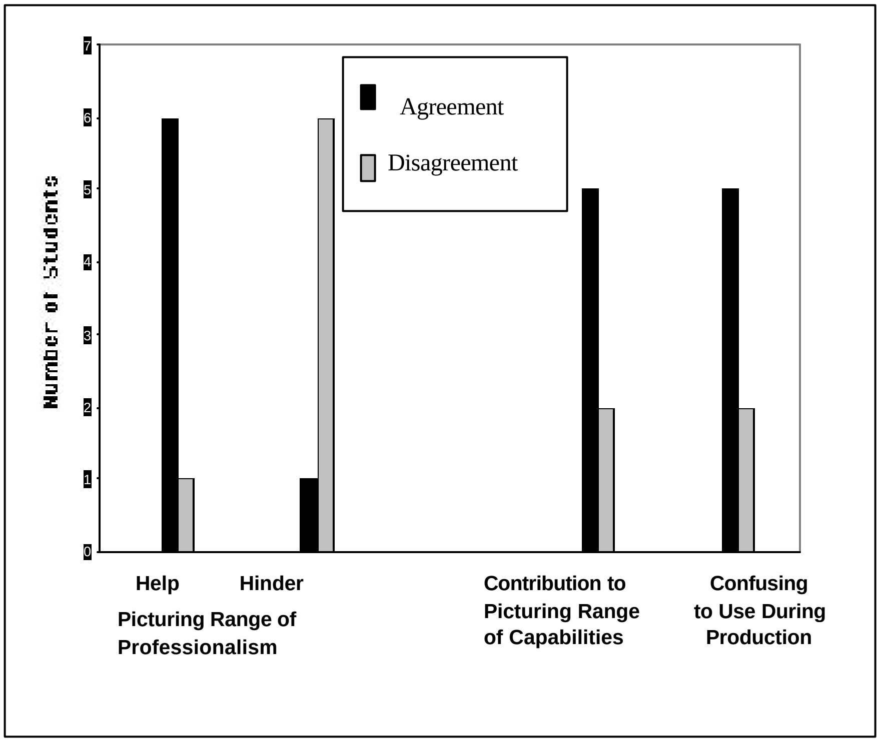

Figure 2. Perceptions of the usefulness of the five domains of an educational technologist when conceptualizing one's range of professionalism and as an educational technologist and of the contribution that the domains made to this picture in a professional electronic portfolio.

That same number of students state they would not employ the domains if they were not required to do so, although five of them do plan to retain usage of the domains (see Figure 3).

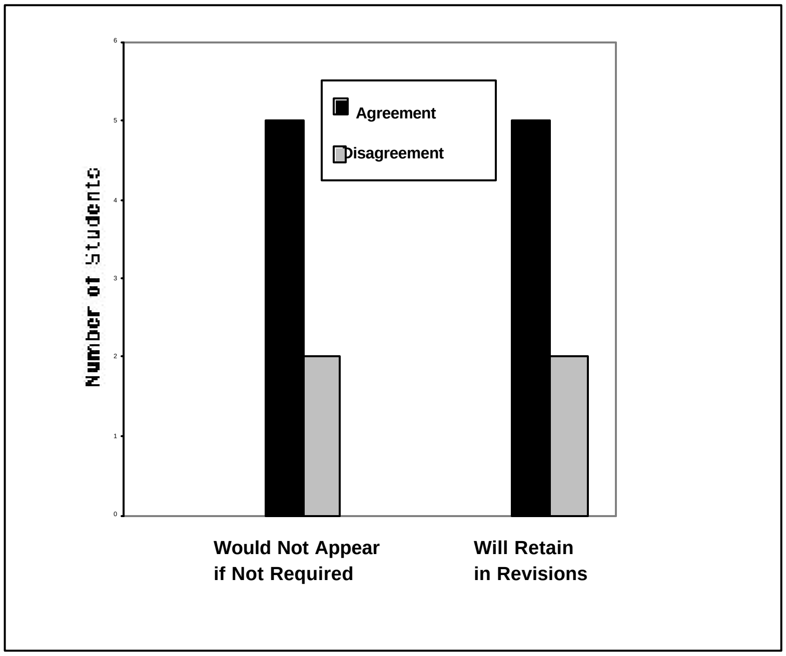

Figure 3. Perceptions of plans to retain the five domains of an educational technologist to communicate professionalism as an educational in a professional electronic portfolio.

Students' Qualitative Data

Six of the seven respondents completed the open-ended section of the survey that related to the manner in which they conceptualized the examples they selected to represent their professionalism for each of the five domains. Half briefly referenced their selections. Each domain, for example, is expressed in the following manner: for design, "Grant from ETEC 600;" for development, "ETEC 603 Designing a paper-based module;" for management, "ETEC 650 assignments;" for utilization, "ETEC 662 Planning a computer lab (networking)"; and for evaluation, "final project" [master's study]. Of those respondents who expressed their choices in this manner, they referred specifically to nine courses, five of which are required courses in the master's degree program.

The other three respondents offered brief narratives about their knowledge and skills, rather than referencing a course alpha and number. For example, in relation to the domain of design, one student wrote, "Print-based instructional module—surfing lessons" This instructional module was designed following the Dick & Carey instructional design model." A similar example, in relation to the domain of management is expressed as,

A visit to UHM video (on Products Page) based on Mintzberg's (1971) principles of mgmt. I was the director of the video. I served as the liaison between the various actors groups for resources & communication. I was resource allocator & the negotiator in that I made sure the project was recorded, edited, & turned in on time.

Analysis of Portfolios

A review of the portfolios themselves by all the departmental faculty members indicates that all the students completed their portfolios, addressing design and content requirements to a degree deemed acceptable for this newer departmental requirement.

Comparison of Faculty Members' and Students' Qualitative Data

Qualitative data, the students' responses to the open-ended questions, their actual portfolios, and the faculty members' oral comments about the portfolios were analyzed in terms of emergent themes.

Emergent themes during the analysis of the open-ended comments offered by both the students and the faculty members indicate that, although there is some convergence in regard to the issues, students' comments relate primarily to learner guidance about the domains. Specifically, they mention the need to provide information about the domains at the beginning of the process with details about the domains as they develop their portfolios. There are suggestions related to the format that the guidance could assume, such as, a brochure about the domains and examples of portfolios that integrate explicit domain-based information.

To some extent the feedback from the faculty members reflects the students' ideas. The faculty members' note the need for the candidates to be clear and overt in explanations about the domains in their electronic portfolios. To achieve such ends and overall professionalism in portfolios, the faculty members cite a need for a more structured ongoing peer and faculty feedback process during the two plus years of design and development.

In terms of professionalism, the faculty members state that such posture needs to be emphasized in the design and selection of content. They explicitly note this situation in terms of the degree of emphasis given to work-related information over personal data; selection of concise exemplars; use of sophisticated design elements, including decisions about selecting appropriate graphics; and increased focus on the candidates' future worth. Formatting is also mentioned with recommendations for the inclusion of alt tags and pdf files to ensure that awareness of ADA and printing concerns are conveyed.

Of particular note is a reminder to address privacy issues in terms of self and others, such as considering the amount of personal information to make readily available on the WWW and obscuring references to specific individuals, or educational sites, that might occur in samples included in the portfolios. They also call for developing a way for the students to communicate the rich content of these portfolios in a reasonable timeframe, while ensuring professionalism during presentation.

Discussion

Despite introducing the concept of analyzing professional knowledge and skills and overall range of professionalism in relation to the five domains of their field toward the completion of the portfolio process, it is encouraging to note the students' overall positive reaction to the utility of that framework. The process of synthesis required of them, rather than analysis, can be a more challenging intellectual skill. This cognitive demand may be reflected to some extent in the students' mixed feelings about the contribution that the domains make in conveying the range of the students' capabilities.

Perceptions of Domains

Although they primarily agreed (n=5) that the domains did contribute to this picture, the same number also noted that during production the domains were confusing to use. Their comments about the need for additional guidance in regard to the domains, particularly their request for brochures and examples from the portfolios of others, offer support for providing additional information for future learners both about the domains themselves and about applying them to interpret and communicate their capabilities.

At first it might appear that the students do not value the domains as descriptors, as the majority of the students (n=5) indicate that they would not employ them unless required to do. Their acknowledgement (n=5), however, that they plan to retain the domains as descriptors during revisions appears to reflect the worth which they apparently are beginning to place on the domains. A review of the final versions of the portfolios at graduation, when minor revisions were made after the formal presentations also supports this contention.

Expanded descriptions provided by three of the students in regard to addressing each of the domains in their portfolios, as opposed to the other students' succinct references to course alpha and numbers, suggest a deeper integration of the concepts by the former. The reason, however, is not evident from data gathered in this study.

Process Issues

Instructional design issues, thus, are the predominant concerns identified by responses to the survey, in the actual portfolios, and in the faculty members' evaluations. Contextual issues related to resources—hardware and software accessibility—did not appear in any comments other than a reminder from the faculty members about ensuring that the required CD-ROM copy of the portfolios continue to be made to ensure that the students' work not be lost in "cyberspace." The absence of concerns about hardware and software where not surprising. As majors in an educational technology program, personal ownership of a computer is expected. Additionally, generous, successful grant funding has resulted in a relatively high-end technology laboratory being available not only for these majors, but for all in the college of education.

Implications

The students do offer perspectives that indicate their awareness of, as well as the usefulness of, incorporating the five domains into their portfolios, as well as a variation in the level of conceptualizing domain usage. As professionals in the field of educational technology, planning for effective transfer of critical learning experiences is an essential part of their learning. The results of this preliminary investigation about graduate level educational technology students' perspectives of engaging in the electronic portfolio process and their depictions of themselves as designers, developers, users, managers, and evaluators in terms of these five domains suggest future directions for faculty members in similar situations.

Incidental information related to candidates' portfolio development offers a glimpse of the potential connection that might result from the students' efforts in designing and developing their portfolios. Based on a recent summary of Kirkpatrick's classic Four-Level Evaluation Model from the late 1950's (2001), at Level One, Reaction, the participating students hold predominantly positive attitudes toward the utility the domain-centered framework provides. At Level Two, Learning, they appear capable of communicating their knowledge and skills in relation to the domains. A slight suggestion of how Level Three, Behavior on the Job, is offered in terms of most students indicating that they plan to retain the domains as descriptors in future revisions of their portfolios. It may be that they are planning ongoing usage in future work situations. It is nearly impossible to determine in any substantive manner insights about such portfolio usage in terms of Kirkpatrick's evaluation Level Four, Results, as it refers to impact on the job. Preliminary, incidental data do, however, offer a very faint preliminary sketch. One student nearing graduation, who produced a portfolio before the requirement to overtly address the domains existed, received two university-level job offers within three days of posting his portfolio on the WWW. This outcome resulted despite his avoidance of posting his work on a job recruitment site. A recent student, who incorporated the domains in her portfolio and obtained a position as a lecturer at a two-year college, was told after being selected that her portfolio contributed to the decision to hire her.

The mere suggestion of such impact makes continuing efforts in refining the professional electronic portfolio process, particularly for educational technology majors who are expected to communicate their professionalism using newer technologies, essential. It is particularly critical as the portfolio process, in varying formats, gains increasing attention for pre- and in-service educators in all fields (Campbell, Cignetti, Melenyzer, Nettles, & Wyman, Jr., 2001; Sanders, 2000).

Additionally, scaffolding candidates' professional development is an important theme for virtual universities (Collis, 1997). It may well be that an electronic portfolio development process within the WWW environment, one that is continually scrutinized in terms of the process and output can provide such support for educational technology candidates. Future studies conducted by investigators at institutions of higher education in the United States, as well as ones overseas, that offer graduate programs in educational technology would seem warranted to determine the ultimate value of this intended exemplar of professionalism. Given the time and effort that both faculty and students expend on the process it is critical that such studies occur.

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On-line Support and Portfolio Assessment for NETS-T Standards In Pre-Service Programs at a Large Southeastern University

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Abstract

This paper details the theoretical underpinnings of one university's approach to technology integration in its pre-service teacher preparation programs, and the results of a continuous, feedback-driven project to evaluate for technology integration through a student portfolio development process. Portfolios are assessed for multiple education and technology standards. Results of the project to date as well as future plans are shared and discussed.

Georgia State University received a Preparing Tomorrow's Teachers to Use Technology Grant at the Implementation level during the first year of grant awards. In the first year of the grant, the College of Education, as a whole, worked to put standards and assessment procedures into place to meet state and national technology standards. Due to a reorganization of the project management team prior to the second year of funding, a different approach was deemed necessary to meet the requirements of the grant funding. Mini-grants were awarded to faculty teams to support grass-roots level technology integration projects. This paper reports on the development efforts of one such mini-grant. This PT3 mini-grant had two foci: to continue the development of an on-line support system to assist preservice teachers in meeting the NETS-T standards, and the extension of a portfolio development and assessment process to include assessment for NETS-T standards.

Teacher Technology Integration Skills

Federal, state, and local agencies are investing billions of dollars to equip schools with the technology that may well be the key to improving the learning experience of our nation's youth. Despite these gargantuan investments, only 20 percent of the 2.5 million teachers currently working in public schools feel comfortable using these technologies in the classroom (U.S. Department of Education, 1999; *Technology Counts*, 1997). As reeducating the existing teaching force to take full advantage of these technology tools will require expensive professional development over many years, the preparedness of new teachers entering the field becomes critical to the success of these investments to improve education. As the federal government predicts that 2.2 million new teachers will be needed in the next decade, the time to address these issues is now (Milken Exchange on Education Technology, 1999).

Computer technology has been available for use in educational settings for several decades. According to a survey of U.S. state-level technology officials (Trotter, 1999), 42 states require teacher preparation programs to include technology. One might think that by this time colleges of education (COEs) are successfully preparing teachers to integrate technology into instructional practices. However, this has not necessarily been the case. In 1995, the U.S. Office of Technology Assessment (OTA) published a report on the status of teachers and technology. According to the OTA, teachers were not and did not feel adequately prepared to integrate technology into their teaching practices. One of the contributing factors cited was the lack of technology training available in teacher preparation programs at colleges of education (COE). When technology instruction was provided, it involved teaching *about* technology not teaching *with* technology. In most instances, COE faculty did not model technology integration with their preservice students.

According to a recent survey of 416 teacher preparation institutions commissioned by the Milken Exchange of Education Technology, most faculty members did not model the use of instructional technology skills in their teaching (Moursund & Bielefeldt, 1999). In several studies it appears that faculty who are not modeling are also not requiring students to use technology in their lessons or assignments (Lewallen, 1998; U.S. Congress, 1995; Wetzel, 1993).

However, a report produced by the U.S. Department of Education (2000 revealed refreshing news: less experienced teachers were more likely than experienced colleagues to indicate that college course work prepared them to use computers in their classrooms. "84 percent of teachers with 3 or fewer years and 76 percent of teachers with 4 to 9 years of teaching experience reported that college/graduate work prepared them to use these technologies to any extent, compared with 44 percent of teachers with 10 to 19 years and 31 percent of teachers with 20 or more years of teaching experience" (p. 78). While teacher education programs still face obstacles as they prepare preservice teachers, it is evident they are making in-roads.

Teacher education programs across the country struggle with how to increase the technology integration skills of the students they educate. Not only are standards such as the National Educational Technology Standards for Teachers (NETS-T) (International Society for Technology in Education National Educational Technology Standards Project, 2000) being adopted, states are now requiring institutions to *guarantee* the technology proficiency of their graduates (University System of Georgia Board of Regents, 1998). At the rate of technological innovation, will it make any difference if pre-service teachers are taught simple productivity skills for both themselves and their students once the technology changes? What exactly should we be teaching pre-service educators about using technology in their future classrooms? The answer to these questions might help teacher educators to focus not only on what content and skills need to be taught, but also on what instructional strategies might be used in teaching about technology integration.

Factors Hindering Technology Use in the Classroom

Several factors have been cited as hindering new teacher use of technology. These include inadequate training in proper technology skills and methods, lack of technology modeling on the part of their university faculty, lack of positive technology experience in school settings, and university faculty out-of-touch with the technology explosion in schools and how it is effecting teaching practice (Kent & McNergnery, 1999; National Council for Accreditation of Teacher Education, 1997; Persichitte, Tharp, & Cafarella, 1997; Office of Technology Assessment, 1995; Byrum & Cashman, 1993). The re-design of entire teacher education programs is called for.

To this end, the Instructional Technology unit at Georgia State University determined to undertake a two-fold approach to increasing the technology integration skills of preservice teachers. First, in order to facilitate preservice training in proper technology skills, and methods, an on-line support system was developed not only for course use, but also to support the preservice teacher throughout student teaching and on throughout the critical induction experience. Secondly, to address teacher education faculty awareness and knowledge of teacher technology integration skills, and to increase modeling to technology integration skills throughout the preservice teacher experience, a portfolio development process was instituted with the Middle Childhood Education unit. Portfolios are assessed throughout the preservice program for meeting first technology standards, and then for meeting new teacher standards.

Early in 1999, Georgia Governor Roy Barnes formed an Education Reform Study Commission to look at ways to improve Georgia's schools. Governor Barnes used the results of the commission's study to produce the A Plus Education Reform Act of 2000 (2002). Out of the act came technology-related initiatives that impact teachers and teacher preparation programs. Primarily the act holds teacher preparation programs at universities and colleges responsible for their graduates' technology competencies. Universities and colleges

> shall require students in such programs to be proficient in computer and other instructional technology applications and skills including understanding desktop computers, their applications, integration with teaching and curriculum, and their utilization for individualized instruction and classroom management. There shall be a test to assess the proficiency of students enrolled in teacher preparation programs in computer and other instructional technology applications and skills. (p. 68)

Prior to the A Plus Education Reform Act of 2000 (2000), the Middle, Secondary and Instructional Technology Department (MSIT) recognized the need to prepare pre-service teachers in the area of technology integration. The Instructional Technology unit has been working closely with the Middle Childhood Education unit for the past four years to develop a WWW-supported resource based learning environment (RBLE)/methods course called *Teachers and Technology*, IT 3210. This course focuses on and models technology integration. It is a required course for Middle Childhood (MCE), Secondary Education (SEC) students and Foreign Language, Art, and Music (FLAM) students seeking teacher certification, and an elective course for Early Childhood Education students (ECE), as well as Kinesiology/Health (K/H) students seeking certification. The pre-service students generate a portfolio documenting the design of technology-supported instructional environment that facilitates student learning through the design and development of student-centered learning activities. The IT3210 portfolio serves as a starting point for middle grades students who continue with the portfolio assessment process throughout their studies at GSU demonstrating they have met INTASC (Interstate New Teacher Assessment and Support Consortium) Standards (Council of Chief State School Officers, 1999).

IT3210 and its web-based resources address the National Educational Technology Performance Profiles for Teachers as well as supports all six of the National Educational Technology Standards for Teachers (NETS-T) and contributes to student understanding of the INTASC Standards. The middle grades portfolio assessment addresses only the INTASC Standards.

Program Issues – Stand Alone Course or Cross Curriculum Integration?

Many teacher education programs focus on either a stand-alone course, or on a model of technology infused throughout all teacher preparation courses. Some schools, including GSU, have opted to do both. Kovalchick (1997) offers, "An approach that I have found useful is to blend elements from both a competency based models and integrative models into a reflexive approach in which students use technology as both learner and teacher. In this way, preservice teacher education students are challenged through direct experience to generate personally relevant conceptions of technology" (p. 31). Smaldino and Muffoletto (1997) also promote a combination approach. "Our model attempts to blend the contents of the existing single course with the need to nurture technology applications within methods and other courses. Thus, students first gain an understanding of the applications of technology in education in the broad sense, with an in-depth examination of how technology supports learning in specific content areas" (p.37).

Technology Integration Support for Preservice Teachers

Course Design History

Prior to 1997, the technology course at GSU was a stand-alone, skills-based course that focused on the use of technology as a teacher tool. Content included such technology usage as word processing, mail merging a letter home to parents, and using a spreadsheet program to calculate grades. Little to no learning theory or instructional methods were included in the lab-based course. In addition, the technologies covered were basic in nature – telecommunications coverage consisted of e-mail, and in later years, the Internet as a database of lesson plans. As pedagogy played virtually no role in the course, students were allowed to substitute a passing grade on a pencil and paper competency test.

In 1997, at the request of the Middle Childhood Committee, the standard skills-based preservice technology course underwent a major redesign. In the first year, the course refocused from teacher-resource-based, skills-based to a technology-integration-into-the-curriculum approach. This refocus was done in part to address a potential cause of low technology adoption in preservice teachers: deficiencies in technology-integration methods (Leggett & Persichitte, 1998).

In fall semester 1998, the IT unit worked with the MCC to redesign the course to further situate the course content in teaching methods. While maintaining a lecture/lab approach, a WWW-based, resource-based learning environment (RBLE) was introduced as part of the course (Hill, 1999; Shoffner, 1999). The course, and its related resource laden WWW site, incorporates a problem-centered, activity-based approach where the computer applications are anchored in authentic and familiar contexts in which teaching and learning occurs (Cognition and Technology Group at Vanderbilt, 1991; Vygotsky, 1978). This approach is based on the view of an open learning environment in which learners have direct input on the direction of the course based on their needs (Hannafin, 1999; Hannafin, Hall, Land, & Hill, 1994). In navigating through the environment and tackling challenges, it is proposed that students will also develop self-directed learning skills, which will serve them well as they enter the teaching profession. Along with confidence in using the technology, self-directed learning skills have been identified as a characteristic of successful technology-using teachers (Shoffner, 1996). The RBLE can be accessed at http://msit.gsu.edu/IT/3210/index.html . The site map for the course appears below in Figure 1.

At the same time, the course serves as an introductory teaching methods course, introducing preservice students to such concepts as instructional objectives, lesson planning, evaluation, and assessment. The course offers more than teaching the basic ADDIE instructional design model as a way to develop lesson plans while teaching about technology integration skills. In the *Technology for Teachers* course at GSU, the technology is immersed in learning about what being a teacher entails – briefly, planning, learning theory, instructional strategies, classroom management, and assessment. Our hope is that by introducing the technology and the methods together, early in the program, that a) students will forever forward view technology as natural to the learning process as the textbook and the pencil; and b) both the technology *and* the methods will be reinforced throughout their other courses at GSU. One way in which continuity and reinforcement occurs is in the use of portfolios for assessment. In the *Technology for Teachers* course, preservice students generate a portfolio documenting the design of technology-supported instructional environment that facilitates student learning through the design and development of student-centered learning activities. The use of portfolio development and assessment continues throughout the remainder of Middle Childhood Education program of study.

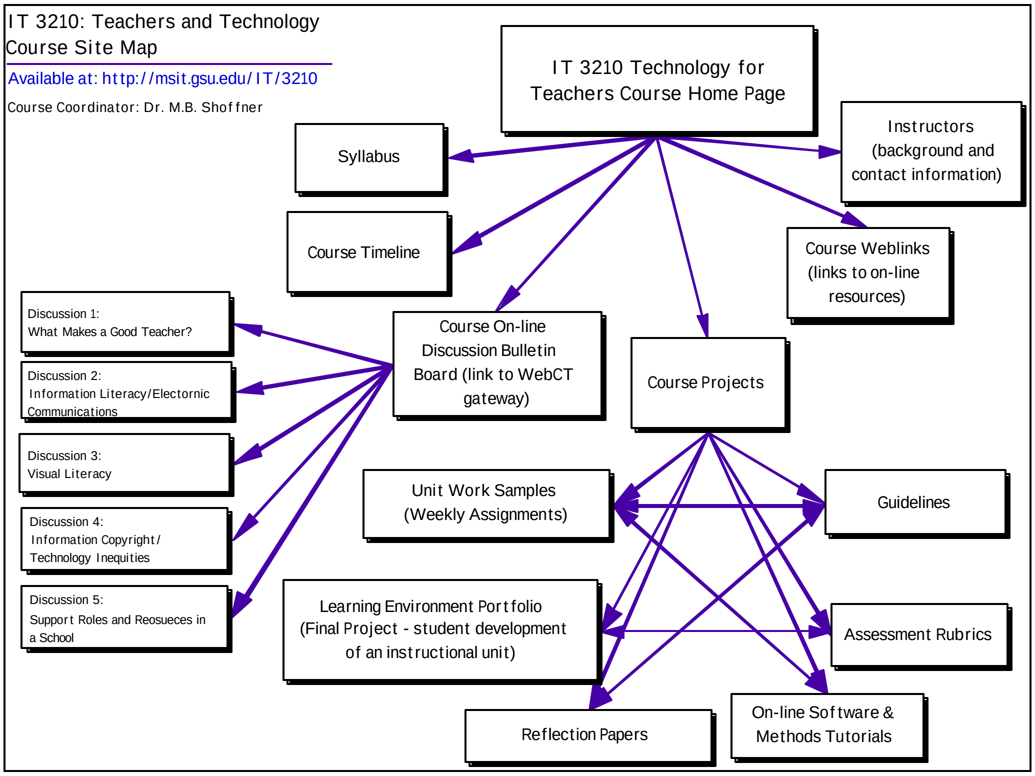

Figure 1. Course Site Map of IT 3210: Teachers and Technology

From Course to On-Line Support System for NETS-T

One focus of this PT3 mini-grant was to expand the IT 3210 *Teachers and Technology* website to provide not only a backdrop for the course but also to serve as a resource for pre-service teachers during their student teaching experience as well as their first year induction period into the teaching profession. To facilitate this continued use, we redesigned the interface of the IT 3210 *Teachers and Technology* resource based learning environment (RBLE). Using the PT3 website development done by the project director in summer 2000, materials were merged into one master RBLE. The interface was changed from a homepage-linked pages interface (http://msit.gsu.edu/IT/3210/index.html) (Figure 2, below) to a frame-set interface (http://msit.gsu.edu/PT3/Shoffner/index.html) (Figure 3, below). The grant team felt this change was necessary to facilitate navigation through what is becoming a very large resource site. When complete, the site will serve not only the IT 3210 audience, but also as a mentoring resource to new teachers in the field. Furthermore, the new frameset navigation will allow users from other universities to more easily access portions of the site for their students (we continue to receive two to three requests for such use each semester). We had hoped the interface frameset would be in place for the entire site (with placeholder pages for approximately on half the content) by the mid March 2001. However, the development of the frameset interface required more time than initially anticipated. Now that the frameset interface is in place, work will resume this fall semester on the authoring and placement of content, as well as the identification of exemplar lesson plans for including in the site.

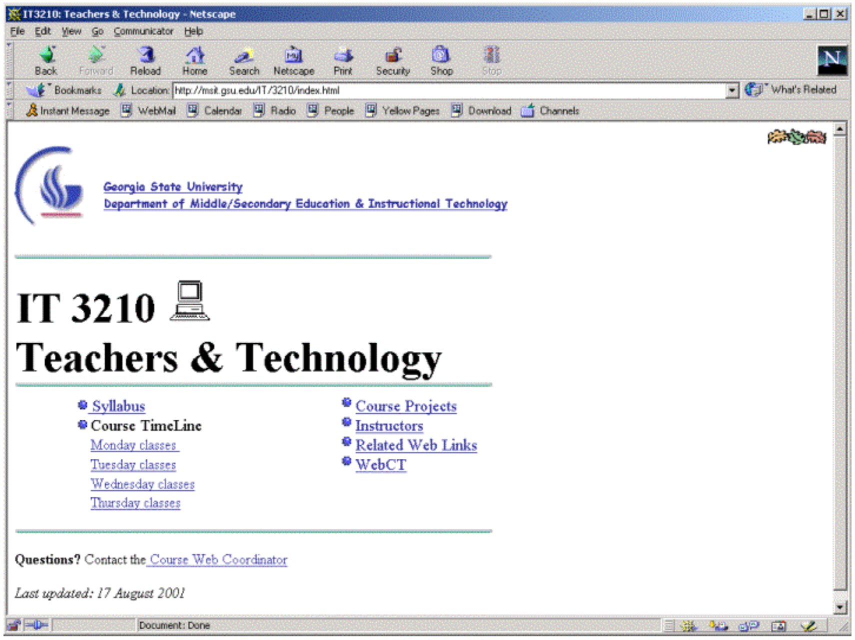

Figure 2. Screen Snap of Current Interface of IT 3210: Teachers and Technology

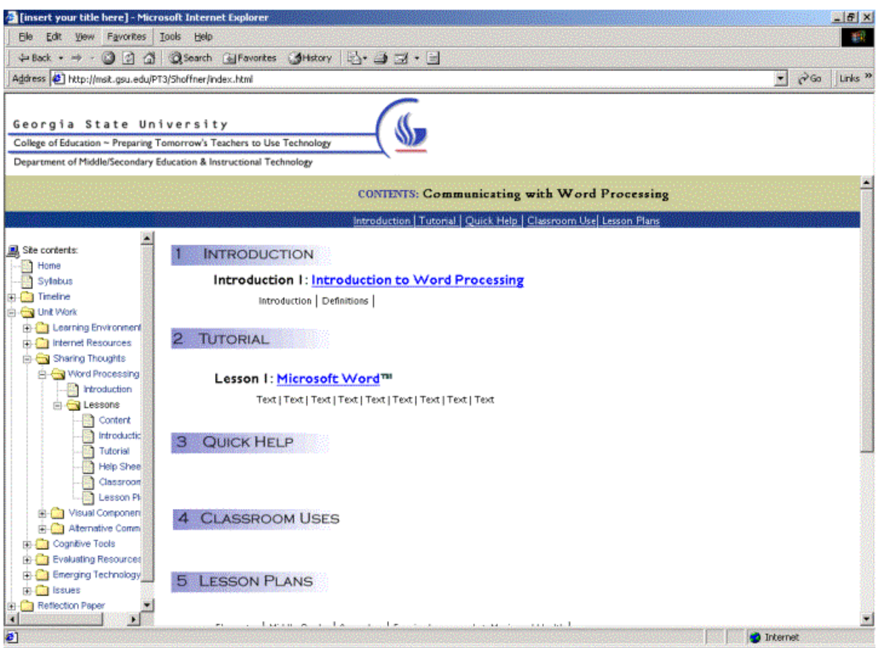

Figure 3. Screen Snap of Frameset Interface of IT 3210: Teachers and Technology Under Development

To assess continued use of the IT 3210 RBLE by preservice teachers throughout their program of study, we planned to mail a follow-up survey to fall 2000 IT 3210 students during the Spring 2001 semester. Informal interviews with fall 2000 IT 3210 students, however, indicated that the time elapsed between the close of the fall semester and the planned mid-March mailing was not sufficient. Students indicated they would be more likely to make use of the RBLE for final semester projects and for field experiences. Due to this feedback, the mailing was postponed to Fall 2001 semester. In spring 2002, fall 2000 IT 3210 cohort students will be surveyed to ascertain their continued use of the RBLE in their GSU coursework. This survey will seek responses to the following questions:

- Do they access the site for support during their GSU class experiences?
- Do they access the site for field-based experiences?
- Do they feel prepared to use computers and the Internet for classroom instruction?
- What are their recommendations for the improvement of the support site?

Performance Profiles and Assessment Instruments

The second portion of the PT3 mini-grant project began more slowly. Assessment instruments were developed for two of the four NETS-T performance profiles: the general preparation performance profile and the professional preparation performance profile. Beginning Spring semester, 2001, all IT 3210 students completed a Likert-type self-report on the general preparation performance profile at the beginning of the semester. As IT 3210 is a part of the professional preparation of middle and secondary education programs, students should meet the general preparation performance profile prior to beginning the course. In the event that a student did not meet the general preparation performance profile at the beginning of professional studies, a second administration occurred upon completion of the IT 3210 course. In addition, all students complete a 24-item self-report on the professional preparation profile at the close of IT 3210. While self-report instruments lack rigor, students who successfully complete the IT 3210 course have been more rigorously assessed for not only the general performance profile, but also 20 of the 24 indicators on the professional preparation performance profile. In time, student self-report results will be correlated to class assignment grades. Sample items on the general preparation and professional preparation self-report instruments appear below in figures 4 and 5, respectively.

Technology Standards for Pre-Service Teachers – General Preparation

Please circle the number corresponding to how well each statement describes you *at this time.*
1 = not at all
2 = a little
3 = somewhat
4 = a lot
5 = very much so!

1. I am comfortable with the keyboard, the mouse, and the basic operation of the computer.	1	2	3	4	5
2. I use the computer for basic tasks on a regular basis.	1	2	3	4	5
3. I use technology tools specific for a given task (for example, graphing calculators, simulation software, and so on).	1	2	3	4	5
4. I use software tools to organize and manipulate data for clearer organization, problem solving, and decision-making.	1	2	3	4	5

Figure 4: Sample Items from the General Preparation Performance Profile Self-Report Instrument

To date, few assessment instruments for NETS-T developed by other PT3 initiatives have been identified. Conference presentations and discussions with colleagues inform us that a comparable assessment instrument for NETS-T is currently being validated at another university. As no other evaluation instruments were reported on, we anticipate using this validated rubric when it becomes available to in turn validate the GSU rubrics.

Technology Standards for Pre-Service Teachers – Professional Preparation

Please circle the number corresponding to how well each statement describes you *at this time.*

1 = not at all
2 = a little
3 = somewhat
4 = a lot
5 = very much so!

1. I can identify the benefits of technology to maximize student learning and facilitate higher order thinking skills.	1	2	3	4	5
2. I differentiate between appropriate and inappropriate uses of technology for teaching and learning while using electronic resources to design and implement learning activities.	1	2	3	4	5
3. I can identify technology resources available in schools and analyze how accessibility to those resources affects planning for instruction.	1	2	3	4	5
4. I can identify, select, and use hardware and software technology resources specially designed for use by PK-12 students to meet specific teaching and learning objectives.	1	2	3	4	5

Figure 5: Sample Items from the Professional Preparation Performance Profile Self-Report Instrument

Summary data collected using the NETS-T general preparation profile and profession preparation profile self-report instruments completed by Spring 20001 IT 3210 students is included in Table 1, below. At the beginning of the IT 3210 class, students showed an average composite score on the general preparation profile of 42 points of a possible 70 points. A score of 42 is the equivalent of students feeling they can "somewhat" meet all 14 indicators. In comparison, at the end of the class, average student composite scores on the general performance profile instrument for those same students increased to 54 points, indicating students felt more adept and comfortable with the technology. A larger net gain in average composite score would be expected; these are skills the student should have prior to entering their professional preparation. One possible explanation for this result is that students overrate their abilities at the beginning of a new course, particularly in the area of technology. Simply put, they don't know what it is they don't know. This theory is supported by the reduction of scores reported on the posttest by some students, indicating they didn't feel as confident in their skills and usage after completed the intensive course.

	General Preparation Performance Profile Self-Report *Pretest*	**General Preparation Performance Profile Self-Report** *Post test*	**Professional Preparation Performance Profile Self-Report** *Post Test Only*
Mean– Composite Score	42.1	54.0	91.2
St. Dev.– Composite Score	13.6	9.8	18.6
# items	14	14	29
Composite Score Possible Range	0 - 70	0 - 70	0 - 145
Composite Score Actual Range	18 - 67	33 - 70	39 – 120

Table 1: NETS-T Self-Report Instrument Summary Data – Matched-Pre-Test Post test Data Only

MCE Portfolio Review

The Middle Childhood Education Unit and the Instructional Technology Unit together formed a program oversight committee, the Middle Childhood Committee (MCC). At GSU, The MCC established a continuous process of portfolio development and assessment for all students (Shoffner, Dias, & Thomas, 2001Shoffner, Thomas, & Dias, 2001). This was a key process for integrating technology across the program and into the content of every course. In response to the Board of Regents guarantee principle, increasing accountability in teacher preparation programs, and the Middle Childhood Committee's recommendation to strengthen the preservice teachers' overall professional development, the committee recommended that the program include an exit assessment that examined the student's ability to apply what they learned in all their courses in some cohesive manner. After examining several assessment models, both traditional and alternative, a portfolio development process with benchmarks throughout the program and final submission as an exit requirement was adopted.

Although most skills and concepts are developed in individual courses, it is important that preservice teachers have command of these concepts and skills with knowledge of how to integrate these concepts and skills into all aspects of teaching. Therefore, a major goal of portfolio requirement was to develop the preservice students' ability to integrate several components of the program across all courses and to develop knowledge and skills in applying these components in all aspects of teaching. Among key skills and concepts under discussion were: integrating technology into learning, developing and implementing lesson plans and assessment strategies, developing and implementing a classroom management plan, working with diverse learners, developing as reflective practitioners, and so on. After a review of the principles of the Interstate New Teacher Assessment and Support Consortium (INTASC), the committee agreed that the principles of INTASC encompassed and addressed all major components of the middle childhood program and could be used to facilitate the development of the preservice teachers. Thus the committee established portfolio guidelines that focused on the ten principles of INTASC.

Through the continuous collaboration of the MCC, guidelines for portfolio development were documented, benchmarks were established, implementation procedures were outlined, and an assessment instrument and procedures were designed. The committee reviewed course syllabi for all MCE undergraduate education courses to determine which INTASC principles were met in each course. The principles were aligned with the program's schedule of course sequence and experiences to establish which principles the preservice students would be able to address at established intervals. These intervals serve as benchmarks to assess the students' portfolios. Portfolio development is introduced in the Teachers and Technology course in the form of the learning environment portfolio. Subsequent submissions are based on the INTASC principles, and occur at the end of the first year of professional studies, prior to student teaching, and at the close of student teaching.

Another aspect of our PT3 mini-grant study was to determine if subsequent MCE student portfolios could be examined to determine preservice students' ability to meet NETS-T standards as they continue through their professional preparation program. A rubric was developed for the 24 indicators of the professional preparation performance profile and applied to Middle Childhood Education student portfolios submitted prior to entrance to the professional sequence of coursework. *(Note: the rubric is too long and detailed to be included within this paper, but can be obtained from the authors upon request.)* The objective of these portfolios was for students to demonstrate six of ten INTASC principles. We were hopeful that data analysis would indicate that students continue to apply the technology integration skills mastered in IT 3210 to other courses in their program of study.

However, that was not the case. Review of six MCE INTASC portfolios submitted in May 2001 showed little student documentation of technology competencies. It was surmised that as students were not specifically directed to demonstrate technology competencies, they simply did not do so. A second factor that might have contributed to the lack of technology demonstrated in these portfolios was timing. Several MCE students were compiling their IT 3210 portfolios at the same time as they were compiling the IT 3210 portfolios. It is conceivable that technology artifacts went in one portfolio, and not the other.

Consultation with MCE faculty indicated that asking MCE students to specifically include technology in their INTASC might dilute the attention they paid to addressing the INTASC principles. Furthermore, it was decided that review of all MCE courses should be conducted to determine when and where students were addressing technology integration skills.

MCE Program Review

In order to determine what NETS-T performance indicators were addressed and reinforced in each of the courses that make up the MCE program, a matrix was developed for MCE faculty in May 2001. The matrix, included in appendix I, maps the NETS-T performance indicators for the general preparation profile, the professional preparation profile, and the student teaching/internship profile against all courses in the MCE program. Faculty were asked mark what performance indicators were addressed in their courses (regardless of indicator level) prior to the October 2001 meeting. To date, data from seven courses in four content areas have been received. The data from the remaining nineteen courses are expected when the MCE faculty meets in early October. Once all courses have been reviewed, decisions will be made to ensure students meet all NETS-T performance indicators in their coursework at GSU. In addition, once coverage of all NETS-T standards has been assured, the MCE INTASC portfolio will be accepted in electronic format only.

Conclusions

Accountability directives for new teacher preparedness are not likely to go away any time soon. Indeed, in his first month in office, United States President Bush proposed education initiatives to increase teacher accountability similar to those in place in the state of Georgia be implemented nationwide. Instructional technology preparation will likely continue to be a critical issue in teacher education for many years to come. Instructional technology units can no longer teach only to their corporate training design and development roots. For colleges of education to successfully prepare teachers for the 21st century, instructional technology will need to be more cohesively included in teacher preparation programs. It is imperative that more cooperative partnerships be established between instructional technology units and initial preparation programs. The authors encourage IT units to initiate and nurture these partnerships, making possible more innovative approaches to this important field of study. While many PT3 initiatives are on too large of a scale to be adopted without a large commitment from teacher education programs, the strategies presented in this paper may be attempted at any institution with little risk.

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Facilitating Technology Integration Through Effective Professional Development: A Local School Model

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Abstract

The purpose of this study was to develop a comprehensive model for local school technology professional development that facilitated technology integration into the curriculum. The local school technology committee conducted an informal performance analysis to determine a plan of action. As a needs assessment, stakeholders were surveyed to determine requisite technology professional development for the local school staff. From this data, a long-range professional development plan was created, including goals and objectives for each year, an in-depth yearly plan with detailed implementation procedures for each objective, and individual teacher plans. The goal of the professional development plan was to increase staff technology skills by 5% as measured by the Technology Skills Assessment. A comparison of pre- and post-assessments indicated that participants increased technology skills by 29.59%. During the pretest, 50% of the participants scored in the beginner skill level. A posttest comparison revealed that none of the participants scored in the beginner level; all participants scored in the intermediate or advanced category.

As we move forward in the twenty-first century, our world is undergoing a technological revolution much like the industrial revolution of the nineteenth century. Technology is permeating and transforming every part of our society. In the face of these rapid changes in business and at home, technology literacy is more important than ever. In order for our graduates to be prepared to meet the challenges of the business world in the twenty-first century, they must be proficient at accessing, evaluating, and communicating information. As businesses learn to compete in a global environment, students must also become globally aware and able to use technology resources that exist beyond the walls of the classroom. Students preparing for this global workplace must be able to use technology or "face a lifetime of menial work" (U. S. Department of Labor, 1991, p. 15).

The National Center for Educational Statistics (2000) reported that the average number of computers in classrooms in the United States has grown significantly in the last twenty years. This number has grown from one computer for every 125 students in 1983 to one computer for every six students in 1998. In addition, Internet availability in public schools has increased from 35 to 95 percent between 1994 and 1998. Unfortunately, availability has not ensured use.
Policymakers and the public are beginning to question the effectiveness of these substantial investments in equipment and infrastructure and demand evidence that they have been worthwhile (Trotter, 1998). Some suggest that if all the computers were taken from schools tomorrow, it would not make a difference. In contrast, businesses in this country would be immobilized without technology (Peck & Dorricott, 1994). Why is it that "businesses have been building electronic highways while education has been creating an electronic dirt road?" (D'Ignazio, 1993, p.11).

Substantial investments in technology hardware, software, and infrastructure will not impact teaching and learning until teachers have the technology skills and technology integration strategies needed for today's modern classrooms. McKenzie (1999) suggests, "The best way to encourage teachers to embrace these technologies is to give them personal learning experiences which win them over to the worthwhile classroom activities which are now possible" (p.6). Local schools and districts must concentrate on professional development to reap a significant return on these investments (Rettig-Seitam, 2000).

Purpose of the Study

The purpose of this study was to develop and implement a comprehensive model for local school technology professional development that facilitated technology integration into the curriculum. Although states such as Georgia (State Data and Research Center of the Georgia Institute of Technology, 2001), Florida (Swain, 2000), Michigan (Hoffman & Thompson, 2000) and North Carolina (Walbert, 2000) have begun to fill the gap in providing much needed training for teachers, effective local school models are still needed. Many teachers have received little or no technology integration training, because the diffusion process is very slow. Well-designed local school plans can augment state initiatives and provide the professional development teachers need to successfully integrate technology into instruction.

Staff development models that focus on school improvement initiatives are often initiated to address a problem. The successful completion of the initiative may call for teachers to gain specific knowledge or skills. This information may be obtained through reading, discussion, observation, training, or trial and error. In other cases, experiential learning may occur in the development and improvement process. The model developed and implemented in this study is a combination of the knowledge that results from teacher involvement in a development and improvement process (Sparks & Loucks-Horsley, 1989).

The development and implementation of the model was a multi-step process. The first step was to identify the theoretical underpinnings that formed the background for the study and to detail the assumptions on which the model was based. The development of the model and assessment plan included an informal performance analysis, development of needs assessment instruments for all stakeholders, creation of the implementation plan, and development of the pre- and post-assessments.

Assumptions of the model

The first assumption on which this model is based is that adults learn most effectively when they have a need to know or solve a real-life problem (Knowles, 1980). Knowles' theory of adult learning has become well known in recent years and proposes the following assumptions of adult learning:

1. Adults have a need to be self-directing.
2. Adults bring a wealth of experience that should be used in a learning situation.
3. Adults' readiness to learn is based on a need to solve a problem.
4. Adults want to make immediate application of knowledge.

Teachers serving on a school improvement team may need to review research on effective teaching, learn new group and interpersonal skills, or acquire content knowledge for new curriculum initiatives. In each of the above examples, teachers' learning is motivated by the need to solve a problem.

Secondly, this model assumes that those working closest to the problem best understand what is needed to improve their performance. Teachers rely on their teaching experiences to guide them as they identify problems and develop solutions. Given the opportunity, the unique perspective of teachers can add to the school improvement process (Sparks & Loucks-Horsley, 1989).

Finally, this model assumes that teachers obtain important knowledge through their participation in the school improvement process. Teachers' involvement in the process may foster alteration in attitudes or the development of problem-solving skills as individuals or groups work toward the solution of a problem. For example, teachers may begin to appreciate individual differences, improve group leadership skills, or just become more aware of the perspective of other staff members. Although this type of learning may be difficult to predict, it is significant to the teachers (Sparks & Loucks-Horsley, 1989)

Description of the Population

The population involved in this study was the staff of an elementary school in a metropolitan area of a large city in the southeastern United States. The staff had 69 certified teachers, 17 teacher assistants, 2 school counselors, 2 speech and language pathologists, 1 technology support technician, 5 clerical staff, 1 clinic worker, 8 cafeteria staff, 4 custodians and 3 administrators. Among all certified teachers, 32 held a Masters degree or higher, 6 had gifted certification, 3 had ESOL certification and 7 had special education certification. New teachers to the school were provided with a mentor who was available for planning and helping with basic information and procedures. The professional learning community worked together in a collaborative manner to promote teaching and learning and achieve annual school goals.

The school was organized using a leadership model known as Shared Governance. Each grade level, including teacher assistants and clerical personnel, had a chairperson who met with the administrators every month to coordinate and discuss curriculum matters, school organization, areas of concern and monitor the Local School Plan for Improvement (LSPI). Dialogue flowed to and from the individual grade level groups through the communication vehicle of the Shared Leadership Team (SLT). SLT made decisions after careful consideration of colleague feedback and available data.

The school had been honored as a School of Excellence and was committed to the continuous improvement process. The Local School Plan for Improvement (LSPI) was written each year using pertinent data and input from the staff. LSPI goals identified specific improvement efforts. Each staff member set individual goals based on the local school LSPI goals. When staff members successfully completed their individual goals the payoff was seen in improved school-wide LSPI results. Certainly, one of the major benefits of the LSPI was the opportunity for staff development in the identified areas of improvement. Teachers had the opportunity to improve teaching strategies and learn cutting edge research at the local school.

Development of the Professional Development Model And Assessment Plan

With the 1998 completion of the school network, every classroom received a multimedia computer with Internet, email, and a laser printer, and the school had three computer labs with Internet connections. As technology resources increased, teachers requested more on-site technology professional development. To meet the growing demands, the technology coordinator worked the technology committee to develop a comprehensive plan for technology professional development. The development of this plan was based on the principles of instructional system design described by Reigeluth, Benathy, and Olsen (1993) and Mager and Pipe (1997), which included a performance analysis, a needs assessment, the development and implementation of a professional development plan and the assessment of the impact of the professional development plan.

<u>Performance Analysis</u>

Although the school had received a large infusion of technology in the last several years, classroom computers were not being fully utilized and computer labs were mainly being used for drill and practice activities. The school leadership team and technology committee recognized this problem and began to investigate solutions that would foster technology integration into the curriculum. This was important because the district had invested about a million dollars in technology hardware, software, and infrastructure in each elementary school in the district. With the district's focus on accountability for results and continuous improvement, the local schools were being asked to measure the impact of technology on teaching and learning. The technology committee and school leadership team realized that the majority of the teachers did not feel they were adequately prepared to use the new technology tools in instruction.

Needs Assessment

With the completion of the preliminary performance analysis, the technology committee developed several surveys to ensure that the interests, values, and perspectives of all stakeholders would be represented in any instructional design or organizational change. The stakeholders- -all the groups who had a stake in the instructional system being designed- - in this project included teachers, assistant teachers, students, and parents (Reigeluth, 1996). The survey of veteran teachers included questions on staff development preferences such as class organization, session length, optimal time of day for instruction, teacher interests and needs, and obstacles to success. The new teacher survey was designed to identify baseline skills for new staff members. The purpose was to identify any significant training gaps between existing staff and new staff. The survey of the assistant teachers sought to identify essentials skills that support staff needed to effectively aid teachers with instruction. Student surveys were designed to identify technology skills that fourth and fifth grade students could complete independently. The survey included skills identified in the instructional technology competencies developed by the local school district. The parent survey was designed to gain the parents' perspectives and knowledge of local school technology initiatives.

Intervention Selection and Development

Prior to the development of the implementation plan, a careful analysis of data from all the stakeholders' surveys was completed to determine needs and interests of the local school staff. The first step in the process was the development of a long-range plan. This overview included the goal for the professional development plan and objectives for each year. Second, an in-depth yearly plan was developed with detailed implementation procedures for each objective. Each objective listed baseline data, indicators of success, measurement tools, an implementation plan of activities, responsible parties, and completion dates. Next, an individual teacher professional development plan was created. This plan was directly correlated to the yearly implementation plan. The individual teacher plan also included a professional development log and a rubric for administrators to use in evaluating individual teacher professional development plans. Based on data from all the stakeholder surveys, a menu of technology professional development classes was developed to support the implementation plan. Due to the wide range in teacher knowledge and skills, provisions were also made for an independent study option.

Implementation of Professional Development Plan

In the early fall, the technology committee completed surveys of all stakeholders. The data was compiled and analyzed for strengths and weaknesses. The results were used to plan technology professional development for the school year. A menu of 29 classes was created by the end of September. Based on the yearly professional development plan, each teacher developed a personal plan for improvement. In January, the administrator on the technology committee and the technology specialist met with each grade level to informally discuss the progress made on the school goals. In addition, each certified staff member met with the technology administrator in January and February for an interim review of progress on individual teacher goals.

Implementation Assessment

A pretest-posttest design was used to assess the implementation plan. Pretests were administered in August 1999 and posttests were completed in April 2000. Teachers were assigned code numbers to maintain the confidentiality of the pretest and posttest data. Data analysis involved the comparison of pretest and posttest data for each objective of the yearly implementation plan. Analysis of the data was completed for each grade level and for the entire staff. The analysis gave a percentile score and a beginner, intermediate, or advanced skill level for each teacher and an average for the entire staff.

Summary

The development of this plan took several months and implementation spanned an entire school year. Throughout the process, the staff at the local school was given opportunities to evaluate the progress toward the professional development goals. This type of feedback spiral was designed to foster continuous improvement through individual growth, as well as growth of the local school organization (Costa & Kallick, 1995).

Methods

In order to develop the plan and to assess its effectiveness, data was collected at three stages, performance analysis, needs assessment, and assessment of the professional development plan. Data collected at each of the first two stages informed the development of the next stage.

Performance Analysis

The technology committee conducted an informal performance analysis. The committee was composed of an assistant principal, the technology specialist, the media specialist, and one representative from each grade level. The data examined during this process included the amount of money spent on technology resources in the past few years, the usage of classroom computers and labs, and teacher preparedness to use technology tools to enhance instruction.

Needs Assessment

Prior to the development and implementation of the professional development model, survey data was collected from all stakeholders to ensure that the interests and needs of each group would be addressed by the plan. Veteran teachers, new teachers, and teacher assistants were surveyed about technology professional development needs and interests. Sixty-five veteran teachers, twelve new teachers, and twelve teacher assistants at the local school participated in the needs assessment. In addition, parents and students were surveyed. All surveys were in paper and pencil format and were distributed and collected by members of the technology committee.

Assessment of the Implementation Plan

A self-assessment instrument was developed to gage teacher progress in acquiring technology integration skills. The paper and pencil assessment contained twenty questions to monitor teacher progress. For each question, teachers were to mark their proficiency level from one to five, with level one indicating a minimum skill level and level five indicating a maximum skill level.

Results

Veteran teachers, new teachers, and teacher assistants were surveyed about technology professional development needs and interests. Sixty-five surveys (100%) were received from veteran teachers, 12 surveys (100%) were received from new teachers, and 12 surveys (100%) were received from teacher assistants at the local school. In addition, 303 parents and students were surveyed. The fourth and fifth grade students returned 266 surveys (88%). Parents returned 99 surveys (33%). Due to the low return rate, parent data was not used in the project development.

Teacher Surveys

Veteran teachers were asked to respond to six questions concerning technology professional development needs, interests, and preferences. Table 1 shows the survey results. Percentages were rounded to the nearest whole number.

An analysis of survey data indicated the following staff development preferences: small group classes (72%) and class sessions of 30 minutes to 2 hours (96%). Major areas of interest for technology use included technology to assist in the organization and access of student information (34%), technology used as an integral part of lesson plans (35%), and technology to improve students' writing skills (31%). Teachers indicated that the biggest obstacle to technology integration was lack of time to plan technology -connected units (75%).

Table 1. Teacher Professional Development Preferences
N=65

Teacher Professional Development Preferences	Frequency	Percentage
Technology staff development can best meet my needs when it is		
Taught in small grade level groups	47	72
Taught one on one	6	9
Taught in a large group lab setting	12	18
Technology staff development can best meet my needs when taught in		
Mini class sessions (30 minutes)	30	46
In-depth sessions (1 - 2 hours)	31	48
Very in -depth sessions (1/2 day or 1 day)	4	6
Technology staff development can best meet my needs when offered		
During the contract day - before school	29	45
During the contract day - after school	6	9
During the contract day - during a planning period	6	9
As an SDU class before school - not on contract time	13	20
As an SDU class after school - not on contract time	19	29
Technology staff development can best meet my needs when classes are		
Organized by beginning, intermediate or advanced skill levels	31	48
Organized by topics of interest with mixed technology skill levels	22	34
Are organized according to grade level needs and interests	14	22
I am most interested in learning to use technology		
That can average my grades and print reports for parents	14	22
That will help me to organize and access student information	22	34
To improve communication with parents and students	14	22
As an integral part of my regular lesson plans	23	35

To assist my students in learning the research process	15	23
To assist my students in improving keyboarding skills	8	12
To assist my students in improving writing skills	20	31
The biggest obstacle I face in integrating technology into the curriculum is		
Lack of time to plan technology-connected lesson/units	49	75
Insufficient access to computer hardware/equipment	8	12
Insufficient access to instructional software	10	15
Insufficient training in the use of the technology tools	12	18
Not comfortable using technology with students	1	2

New Teacher Survey

The survey of new teachers included first year teachers and teachers who were new to the local school involved in this project. The survey was designed to identify gaps in teacher technology skills. Table 2 indicates new teacher survey results. Percentages were rounded to the nearest whole number.

Analysis of the results indicated staff development needs in several areas. In basic network navigation, only 25% of teacher could log on or off the network and 17% could save file to the school server. Second, 17% of the teachers reported that they could detach e-mail attachments or create e-mail groups. Other needs identified included using satellite or distance learning resources, using Accelerated Reader to support reading, creating a basic web page, and basic computer troubleshooting skills.

Table 2. New Teacher Technology Professional Development Needs
N=12

New Teacher Technology Skills	Frequency	Percentage
Knows correct way to start up and shut down a computer with Windows 95	12	100
Knows how to log on and log off of Novell Netware	3	25
Knows Windows 95 basics such as minimize, maximize, open, close, & quit	12	100
Knows how to use Windows 95 Explorer to organize personal computer files	2	17
Knows how to save files to the courseware server	2	17
Knows how to back up network files to floppy disk	4	33
Knows word processing basics such as changing fonts, size, and style	10	83
Can save and print word processing files	11	92
Can copy and paste graphics and text in word processing	5	42
Can create tables in word processing	1	8
Can create newsletters in word processing	6	50
Can reply and forward email	10	83
Can send email attachments	4	33
Can detach email attachments and save to the courseware server	2	17
Can create email groups	2	17
Can type in an internet web address and bookmark a web site	7	58
Knows how to use an internet search engine such a Yahoo	8	67
Knows how to make a basic web page	2	17
Knows how to plan and manage taking a class to computer lab	8	67
Can create and teach a technology-connected lesson plan	6	50
Knows how to us satellite resources such as the Peach Star Pipeline to support instruction	2	17
Knows how to use the Accelerated Reader program to support reading instruction	2	17
Knows how to use computer tutorials or the help menu in computer programs	2	17
Can troubleshoot a frozen computer or a jammed printer	2	17

Teacher Assistant Survey Results

The teacher assistant survey was designed to identify gaps in skills needed to support instruction. Table 3 shows data from teacher assistant surveys. Percentages were rounded to the nearest whole number. An analysis of survey data indicated greatest needs for additional training in the areas of e-mail attachments, using the computer for student drill and practice, and basic computer troubleshooting.

Table 3. Teacher Assistant Survey Results

N=12

Technology Skills	Can do task independently Percentage	Can do task with assistance Percentage	Cannot do this task Percentage
I can start up, log on, log off and shut down an IBM computer.	100	0	0
I know how to search for a book or video on the media center online card catalog.	100	0	0
I can save to the server and print in word processing	43	17	25
I can access my e-mail account	75	0	25
I can reply and forward e-mail	58	17	25
I can troubleshoot a frozen computer.	17	17	50
I can use the classroom computer for student drill & practice, and/or educational games.	8	8	50
I know Windows 95 basics such as minimize, maximize, close and quit	100	0	0
I know word processing basics such as changing fonts, size and style.	42	25	25
I can send e-mail attachments.	8	25	50

Student Technology Survey Results

Student surveys were designed to identify technology skills that fourth and fifth grade students could complete independently. The survey included skills identified in the elementary instructional technology competencies developed by the local school district. Table 4 shows data from the student surveys.

Table 4. Student Technology Survey Results

N = 266

Technology Skills	Can do task independently Frequency	Can do task with assistance Frequency	Cannot do this task Frequency
I can use the correct finder positions for keyboarding.	137	48	81
I can edit my own writing using spell checker.	153	53	26
I can change fonts and sizes in word processing.	189	27	11
I can save my work.	191	23	9
I can print my work.	182	28	10
I know how to go to or look up web sites on the internet.	129	60	35
I know how to search for information on the internet or CD ROM to complete classroom assignments.	110	77	40
I know how to start, minimize, close, quit and shut down the computer.	158	49	15
I know how to properly load and eject a CD ROM from a computer.	190	26	9
I know how to make a Kid Pix slide show.	94	88	42

Assessment of Implementation Plan

A pretest-posttest design was used to assess the effect the yearly implementation plan. Teachers were assigned code numbers to maintain the confidentiality of the pretest and posttest data. Analysis of the data was completed for each grade level and for the entire staff. The analysis provided a percentage, a skill level for each teacher, and a mean score for the entire staff.

A pretest and posttest was administered to all certified teachers. Scores were reported in percentages. A score between 0 and 39% indicated a beginner skill level, a score between 40 and 79% indicated an intermediate skill level, and a score between 80 and 100% indicated an advanced skill level. Table 5 shows the summary data for the implementation plan.

Table 5. Pretest and posttest summary data

	N	*M*	*SD*	*SE*
Pre	61	43.1	14.7	1.9
Post	61	72.7	13.9	1.8

Tables 6 and 7 compare pretest and posttest skill levels by grade level. On the pretest, only two grade levels had any advanced scores. In comparison, the posttest scores revealed that all grade levels had gained in the advanced skill level except for fourth grade. In addition, all pretest beginners had progressed to intermediate or advanced skill levels.

Table 6. Pretest Staff Skill Levels By Grade Level

Grade	Beginner	Intermediate	Advanced
Kindergarten	6	1	0
1st Grade	4	4	0
2nd Grade	3	5	0
3rd Grade	3	4	1
4th Grade	4	3	0
5th Grade	5	2	0
Teacher Specialists	2	5	0
Special Education	5	5	1
Totals	**32**	**29**	**2**

Table 7. Posttest Staff Skill Levels by Grade Level

Grade	Beginner	Intermediate	Advanced
Kindergarten	0	6	1
1st Grade	0	6	2
2nd Grade	0	3	5
3rd Grade	0	7	1
4th Grade	0	7	0
5th Grade	0	3	4
Teacher Specialists	0	2	5
Special Education	0	5	6
Totals	**0**	**39**	**24**

Discussion

This project attempted to develop and implement a model of local school professional development that facilitated technology integration into the curriculum. Prior to the development of the model, surveys were administered to the stakeholders. The data was compiled and analyzed to identify the needs and concerns that should be addressed by any new professional development initiative.

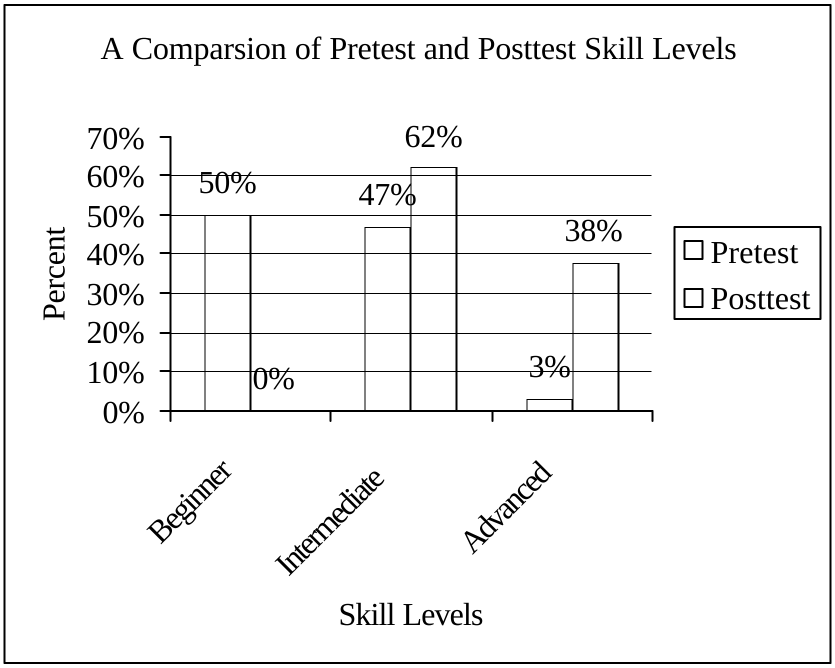
Through the development and implementation of the model, the participants at the local school recognized that all parties were change agents in the technology integration process. Successful integration of technology in the curriculum required the collaboration, shared responsibilities, cooperation, and investments of time and effort from all involved stakeholders.

To facilitate the integration of technology into the curriculum, all staff members at the local school were involved comprehensive on-site technology staff development. Professional development was designed to support the local school improvement plan and district continuous improvement initiatives. Staff members responded positively to the convenience of on-site training, but sometimes training was hampered by local school distractions. The inclusion of an independent study option provided increased flexibility for staff members to pursue some of their own interests for professional growth.

Conclusions

The goal of the professional development plan was to increase staff technology skills by 5% as measured by the Technology Skills Assessment. The mean difference between the pretest and posttest scores was 29.59, which was statistically significant, t_{05}=20.506. In addition, all participants made significant advances in skill level (see Figure 1). During the pretest, 50% of the participants scored in the beginner skill level. A posttest comparison revealed that none of the participants scored in the beginner level. All participants scored in the intermediate or advanced category.

Figure 1. A Comparison of Pretest and Posttest Skill Levels



The main beneficiaries of the extensive focus of technology training were the students. As a result of improved teacher technology skills, students had the opportunity to use technology create multimedia slide shows and web pages, produce live action videos, and use internet and CD ROM resources for research. In addition, several students won county and state media festival awards for multimedia and video projects that were related to the curriculum.

Recommendations

After examining the data from the professional development initiative and reviewing research on effective professional development, the following improvements to the model are recommended for future years of implementation:

1. Offer an on-site menu that includes more choices and less mandated sessions for staff members.
2. Offer options for large group training, small group classes, and one-on-one mentoring to better meet the various learning styles of the staff.
3. Improve and increase follow-up training to ensure successful implementation of the professional development initiative.

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VIRTUAL QUESTS AS LEARNING ENVIRONMENTS FOR K-12 STUDENTS

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Abstract

Virtual quests, such as the MayaQuest expedition produced by Classroom Connect, are excellent examples of classroom experiences that provide students with authentic opportunities to solve real life problems. This applied qualitative study looked at the value of virtual quests as classroom learning environments, at the instructional characteristics of teachers who chose to participate, reviewed related literature, and discussed, from the teacher's perspective, their application in a classroom setting.

Introduction

Use of the Internet in today's classrooms can offer opportunities that enrich and expand existing curriculum, support educational standards, and rejuvenate the teaching and learning process. Access to original documents, photos, video, sound, content experts, and live data, expands the resources available to the learner in a way that can make learning more engaging, interactive and authentic.

Perhaps some of the most engaging, comprehensive and unique, web-based activities are virtual quests that take student participants along on real expeditions, following a team in the field as they explore new territory or do research on authentic scientific problems. This study looked closely at these comprehensive virtual quests, defined their common characteristics, reviewed related literature on their efficacy in the K-12 setting, and discussed, from the teacher's perspective, their application in a classroom setting.

Virtual Quests

Although the term virtual field trip is often used in reference to these large quests, it can be misleading, as the term "virtual field trip" also refers to any number of non-interactive sites that can be found on-line. In contrast, virtual quests have the following unique characteristics:

- **Problem-based**: Focus is on an authentic mystery to be solved,
- **Curricular focus**: National standards support the content,
- **Multidisciplinary**: Resources and activities reach across the disciplines.
- **Real time interactivity**: A team in the field interacts with participants via e-mail, live chats, and video.
- **Participants as stake-holders**: Students are asked to make decisions about the quest that the field team acts on, i.e. should the team give money to beggars, travel through the jungle or into the cave?
- **Website as communication central**: The site contains activities and resources for teachers and students. It is highly visual and interactive, and is the center for daily updates and shared knowledge creation.
- **Scheduled**: The real-time component usually last six to eight weeks, although some last as long as a year.

Classroom Connect sponsors two expeditions a year that follow a team of explorers and scientists on a quest to solve a great mystery. The live experience of the Classroom Connect quests last for four weeks, although the website becomes live one week before the field team starts posting. The broad range of resources available on the site makes it possible for teachers to choose areas of focus most pertinent to their curricular needs.

Comprehensive virtual quests are designed to engage students in learning that includes authentic problem solving, real-time interaction with experts on the field, and an opportunity to share their research data, writing and artwork with an international team of peers. Over the past years I have offered teachers the opportunity to participate in virtual quests with their students, but had received a limited response. Even those who did commit did not take full advantage of the quest activities by following the quest consistently and engaging students.

The purpose of this study was to review associated literature that might support, or not, the validity of virtual quests in classroom, to identify the aspects of student outcome that would justify their use and to better understand the issues of quest implementation in the classroom, so that I might be able support teacher adoption in the future.

Literature Review

Research on the effectiveness of virtual quests is lacking. However, it is possible to examine research on the Internet in the classroom, writing, problem based learning, situated cognition, and anchored instruction.

Michael Ritter, a professor of geography, did a descriptive case study on virtual field trips with his students who visited key locations on-line by following a path of hyperlinked pages, gathered and analyzed data from photos and text, and kept field journals (1998). Ritter stated that the value of virtual field trips for learning geography is that it brings remote, dangerous or expensive locations into the classroom.

Lee and Songer looked at the effect of on-line collaboration on students' discourse about weather science, through the One Sky project (1999). They found that this collaborative on-line experience connected student personal experience with scientific learning. It made science learning more authentic. Students became local experts and knowledge producers and developed a higher level of language applied to science.

Jean Lave, the key proponent of situated cognition, recognizes that learning occurs as a function of activity and that it is situated in the context of the learning environment (1988). The model of situated cognition involves a multidisciplinary, collaborative approach to complex problem solving with embedded data. Brown, Collins and Duguid point out that traditional learning is often disconnected from the context of content (1989). For example, students learn the vocabulary of science by using the dictionary, writing sentences or reading textbooks. This approach is devoid of any structure or clues that might help the student make connections to real meaning. In a situated learning environment, students might be asked to work like scientists, experimenting, observing, hypothesizing and recording. Situated cognition has learning occur within a community or culture of practitioners. Brown, Collins and Duguid note that activity, concept, and the culture of the learning community are interdependent (1989). Students who work and study like scientists are more likely to have a structure on which to build knew scientific knowledge.

Anchored instruction, a concept developed by the John Bransford at the *Cognition and Technology Group at Vanderbilt (CTGV)*, situates authentic problems into what are called macrocontexts, or story-like situations (1993). The problems are anchored around these realistic situations that may involve an adventure. The students can solve the challenge by using information embedded in the story. The story, or anchor, engages the student in realistic and relevant problem solving. Research done by the CTGV found that students:

- performed as well as or better on standardized tests than the control group.
- demonstrated superior performance on multi-step word problems.
- showed less anxiety about mathematics.
- were more likely to see mathematics as relevant to their lives (CTGV, 1993).

In summary, the theory of situated cognition proposes that students are more likely to develop skills that will transfer to new learning situations, if they are engaged in authentic activities that focus on development of problem solving skills. Anchored instruction has applied the theory of situated cognition to the classroom setting and promotes the development of activities that create situated environments.

Virtual quests such as those produced by Classroom Connect and The JASON Project, are anchored learning environments. Students are asked to help scientists in the field find solutions to real world problems. They place students into a community of learners where they can share their observations, responses, data and questions with an authentic audience. They can focus on solving complex problems with the support of the virtual community. Learning content such as math, biology, geography, or culture may even be, in many cases, unintentional or incidental.

The quests produced by Classroom Connect, are examples of comprehensive virtual quests. Its Adventure Learning Division produces the expeditions, and adventure is key to their quest experiences. Their team of explorers travels exotic places on bicycle, a mode of transportation to which students can easily relate. America Quest has taken students to the Four Corners region of the United States, Australia, Central America, Asia, Africa and Galapagos Islands.

Each of their quests must be organized around a real mystery, or what CTGV (1990) would refer to as an anchor or macrocontext. The mystery of the Spring 2000 America Quest expedition focused on the sudden disappearance of the Anasazi people from their homes over 700 years ago. Experts in the field don't have a clear understanding of what happened to the Anasazi. No one knows the answers at the outset, students, teachers or field experts, and it is unlikely that they'll know the answers when the expedition ends. The problem of the disappearance of the Anasazi is a very complex one. Clues are available but they conflict. Some experts say that the Anasazi were violent people; perhaps they were running from their enemies. Others say the opposite is true; they were peaceful and were affected by environmental changes. As participants in America Quest, students are exposed to the complexity of real world problems and the reality that solutions come from considering many perspectives.

Student participants are addressed to directly by the America Quest expedition team. Daily journal postings are written with them in mind, including descriptive language, interesting topics, and lots of multimedia. Students are considered to be members of the team, and are solicited for their input in a number of ways. Many of the postings from the expedition team include polls. Students can email the team, the on-line experts and each other. Responses are posted to the site bulletin board where students are also invited to post. The audience of archaeologists, anthropologists, environmentalists and biologists value their responses acting as mentors to the students' developing knowledge. Immersed in the culture of exploration, students are witnessing the language and behavior of experts in the field. They are called upon by the team to share their input and are being acknowledged for their thought processes.

In order to make informed statements and decisions, students need to do some study and research. America Quest also provided a large amount of archived topical information on its site. Students are encouraged to use whatever online or offline resources are available to them, in the same manner that their teammates in the field do. Immersed in the culture of archaeology and anthropology, students were building knowledge about Anasazi culture, environment and their modern day successors. They are acquiring knowledge as a tool rather than a collection of facts.

Although most classroom participants are not prepared to tackle an investigation of this scale, the contributions they do make are clearly part of the process. There are also several smaller problems that students are called upon to solve. On the America Quest expedition, Dan Buettner presented the students with a weekly ethical dilemma called Dan's Dilemma, for example whether or not to photograph the remain in Hopi gravesites. At the end of the week a summary of students' responses was posted, along with a sample of supporting explanations of their choices. A weekly dilemma calls on them to think outside of themselves, while calling on their own personal experience to make informed decisions.

As with any trip, time, distance, cost, location, and supplies are important things to be aware of.

Figure 1. Example of AmericaQuest Daily Data

GPS position:	35^o 36 minutes N 106^o 20 minutes W
Sunrise:	5:54 AM
Sunset:	6:25 PM
Dental floss used:	133 ft.
Toilet Paper Used:	407 ft.
Pictures Taken:	4608
Miles Biked:	260
Miles Hiked:	52
Flat Tires Fixed:	3
Ailments:	Fatigue, sliver in Dan's finger

The America Quest expedition team has placed a variety of data within the context of the expedition. Figure 1 shows an example of the team's daily postings (Buettner, 2000b). This authentic data, both serious and whimsical, is provided as a resource for study of geography, weather, health, measurement, and mathematical computation. The numbers have meaning within the context of the quest, whereas traditional approaches often stretch to create context for manipulation of data.

Personal, archaeological, biological and anthropological information are presented within the expedition team's posted journal entries. A weekly entry by the team biologist, called "Gross and Disgusting," described items that attract the attention of students but also address issues of a biological nature (2000). For example, the team biologist's entry on March 9, 2000 discussed the discovery of road kill.

" The other day I was … searching for mule deer. I came around a corner and there … was my first animal!

As I got closer I saw it was a cat but it was so bloated and putrid that I didn't want to get too close. (Allen, 2000)

She goes on to discuss what kinds of animals are more likely to become victims of road kill and why, and that bacteria is largely responsible for road kill clean up. It's easy to see that both the topic and language can pull the reader in, drawing attention to what's "gross" and away from the challenges of reading.

In the case of road kill, the team biologist asked students to think about the issue of road kill in Arizona and apply what they'd learned to the entire United States. She polled them on how the United States should reduce the road kill problem. The expedition experience gave the students a structure upon which informed opinions could be made. Situated cognition may also help with the transfer of problem solving skills to new situations (CTGV, 1993).

Multimedia is a major supporting factor in the America Quest experience. Each weekly Kid Profile, for example, included a video of the host student and a recording of them speaking or singing. In some cases they were speaking in the Navaho language. As virtual members of the expedition team, they can experience more closely what the team in the field is experiencing. Another aspect of the audio-visual nature of the quest site is that it supports the varied learning styles of the participants and provides cues for students who may have learning difficulties.

Brown, Collins and Duguid stress the value of the enculturation of the learner into the domain, or content (1989). By observing the members of the new culture, in the case of the America Quest expedition team, archeologists, anthropologists and biologists, students can learn the behavior and language of the field experts. The environment encourages student interaction with the adult experts as well as with other student team members. Students can communicate through email, message boards and occasional scheduled chat rooms.

Collaboration and cooperation are key characteristics of an anchored learning environment (CTGV, 1993). Real world problems are solved in environments where many people contribute to the search for solutions. Complex problems often necessitate the input of many. Students with weaker skills can contribute to the process while they benefit by learning from their peers. The process of problem solving within a group, requires articulation of thought. Students must be clear about their thinking. When posting to the site, the America Quest team chose models of articulate thought, what they referred to as the most interesting questions and responses, to post on the bulletin board. They are able to view good models of communication.

The America Quest experience also builds a sense of community. At each location the team selects a student for the Kid Profile to be interviewed and introduced on the website. Students often have misconceptions about people from different parts of the world or from different cultures. The Kid Profile helps children develop some global awareness and cultural sensitivity. Profiles include information about the student's family, daily routine, school day, personal interests and goals. Students can relate to another child's experiences, and can see the world from a different perspective. This experience can change a student's, and even a teacher's, global awareness.

The Challenges of Quests in the Classroom

Adoption of a new instructional approach is a challenge for any classroom teacher. Accountability for standardized test scores makes it difficult to shift attention from mandated curriculum schedules. For many, a cultural shift also needs to take place in the classroom. Teachers and students must move from the more traditional didactic to a more process oriented learning approach (SCOPE, 2001).

Research has shown that successful adoption of innovations is dependent on six factors: relative advantage, compatibility, complexity, trialability, observability and reinvention (Rogers, p.15-16). Adopters must perceive that the new technology has a relative advantage over the usual way of doing things. Teachers must believe that the quest experience offers enough value to justify modification of mandated curriculum. They need time to explore the quest and talk to other teachers who believe in the quests' value.

Teachers considering participation in a virtual quest, want to know if this new learning environment is compatible with their own their personal values about education. Teachers who favor problem-based, student-centered and process oriented approaches may be best suited for virtual quests. The complexity of an innovation has an impact on its adoption. Innovations perceived as too complex or difficult to understand are less likely to be successfully adopted. A teacher approaching a quest for the first time must be comfortable with the technology and its management in the classroom. They must decide which quest experiences to use, what instructional focus to choose, and how much time to. Trialability is another factor impacting successful adoption. It gives the uncertain adopter an opportunity to experiment, and become comfortable with the new technology. Teachers have the opportunity to visit archived virtual quests on the Quest Channel at Classroom Connect's website prior to the expedition (www.classroom.com), or to visit the quest website before the quest starts. Important, particularly to adoption of any innovation in the educational setting, is the degree to which the impact of an innovation is observable to others, i.e. teachers, parents and administrators. Improved student motivation makes the adoption of innovation more likely. Once an innovation is adopted, if the adopter is able to modify or reinvent the innovation to customize it to their needs, then it is more likely to continue to be used. Quests, such as America Quest, are designed so that the breadth of the experience and resources leaves room for teachers with varying student or curriculum needs to make decisions about what they will focus on and how it will be used. The more often a teacher participates in quests, the more familiar they become with its components and the more easily they can customize the experience for their students.

The introduction of the virtual quest into the classroom environment brings with it the issue of teacher readiness to use technology as an instructional resource. Roger's model for adoption of innovation touches on this issue when considering the adopter's perception of innovation's complexity, i.e., whether or not the teacher is technically ready to integrate technology into the instructional process. According to Sandholtz, Ringstaff and Dwyer, adoption of technology integration happens in five stages: entry, adoption, adaptation, appropriation and invention (1997).

Teachers at the entry stage are struggling with learning how to operate computers and are more likely to rely on teacher directed activities away from the computer. At the adoption stage, teachers have developed some personal skills with computers and begin to show some interest in integrating technology into their lessons. Teachers at these stages may find a virtual quest overwhelming, and are least likely to participate.

It's in the last three phases that change in instructional practices begins to take place. In the adaptation phase, teachers begin to realize that computers can save time, that students are highly motivated and, therefore, more productive. As teachers develop confidence in and mastery of their own technical skills, they begin to realize the natural association of technology and work. At this stage, appropriation, students are working at the computer more, interacting more collaboratively and are more involved in project-based learning. At the height of the integration continuum is the invention stage. It is at this point teachers have moved to a more constructive approach to learning in the classroom, have begun to question more traditional teaching approaches and are frequently collaborating with other teachers. It seems that teachers at these last three stages would be most ready to consider participation in virtual quests, particularly those in the invention stage. Their collaborative and project-based classrooms are well suited for anchored instruction.

In 1993, the Cognitive and Technology Group at Vanderbilt (CTGV) revisited their 1990 classroom implementation of the Jasper Woodbury series and looked at the challenges of teaching an anchored curriculum. They noted that one of the greatest challenges for the teacher was the shift in their role as provider of information to coach.

Teachers in CTGV's research group questioned the value of the Jasper series activities and wondered where it fit into their curriculum. They also worried that taking their students out of the mandated curriculum for a month would impact their achievement test scores. CTGV found that achievement test results of participating students were equal or better than those students that did not participate (CTGV, p. 58). The Classroom Connect quest experiences are designed with national curriculum standards in mind and should make their acceptance as supporting local curriculum easier.

Anchored instruction, problem-based learning and virtual quests lend themselves to portfolio and performance based assessment (SCOPE, 2001 & CTGV, 1993). Virtual quests, such as America Quest, have assessment opportunities built in; the Weekly Quiz is an online review of the event of the week; performance-based rubrics are available in the Teacher's Lounge; and suggestions for developing student portfolios can be found in the teacher's guide.

Students, too, who are used to a more didactic approach to learning, may not know how to participate in a learning environment that is more process oriented and where the path to solving problems is less clear. Used to working as individuals, the shift to cooperative learning may take some training and practice.

In conclusion, virtual quests are excellent examples of learning environments that engage students in real-world problem solving in authentic settings. Research has shown that students engaged in situated, anchored learning environments performed as well as or better on standardized tests than the control group (CTGV, 1993).

Issues of virtual quest adoption in the classroom, however, include consideration of a teacher's readiness to try an innovative approach to instruction, their perception of its compatibility with their teaching style, the ability to which he or she can try it out, see how well it works and modify it to fit their curriculum and instructional style. Because virtual quests are by nature technologically supported, adoption readiness is also contingent on the teachers' level of technology adoption. Teachers who are comfortable with technology themselves and as a classroom resource are more likely to find that virtual quests fit in their classrooms.

Methodology and Results

The 2001 MayaQuest expedition was conducted with six elementary school teachers from the author's school. The teachers registered their classes at the Classroom Connect web site and were committed to incorporate MayaQuest as part of their instructional day. These six teachers were then interviewed about their instructional characteristics, issues surrounding the use of quests in the classroom, and their level of comfort with technology. Although conducted as objective research, the author's enthusiasm for the topic introduced some subjectivity. One fifth grade teacher chose to pair up with a third grade teacher and held a peripheral role in the daily planning. All six teachers agreed to the interviews, which lasted 25-45 minutes and were conducted during their planning time. The MayaQuest project was in its second and third week when the interviews were started.

The interviews were audio taped, transcribed and coded in reference to the three focus areas for this study: 1) teacher instructional characteristics including their comfort with and use of technology as an instructional tool, 2) student outcome as a result of the MayaQuest experience and 3) issues surrounding successful implementation of the quest in the elementary classroom.

Each classroom at Sawnee Elementary School has 5 networked, Internet accessible multimedia computers. Each teacher has her own multimedia notebook computer with a video card that allows for projection to the classroom TV, and that is also network able. In addition, there are three mobile mini-labs that contain ten notebook computers per cart. These notebooks have a wireless connection to the network. Students shared the notebooks or worked individually in an activity center arrangement.

Teacher Instructional Characteristics

All teachers taught regular classrooms that included four fourth grades, one third grade, and one-fifth grade classroom. Three of the teachers had tried previous Classroom Connect virtual quests with limited success.

When asked about their comfort level with technology as an instructional tool, on a scale from 0 (no comfort) to 5 (total comfort), 5 teachers in the group placed themselves well above average (4-5) and one teacher rated herself as average (3). (See the chart below.)

Table 1.Characteristics of Teachers Participating in the Study

Teacher	Grade Level Taught	Years Teaching Experience	Prior Online Project Experience	Technology Comfort Self Rating Out of 5	Self-stated Role in Student Learning	Student Desk Grouping
Anne	3	7	No	4	Facilitator	Groups
Betty	4	11	Yes	4	Guide	Groups
Carol	4	11	Yes	4.5	Facilitator	Groups
Diane	4	4	Yes	4	Facilitator/ Direct Instruction	Rows
Edith	4	5	No	5	Facilitator/ Direct Instruction	Rows/ Grouped
Faye	5	25	Yes	3	Manager	Rows

As a result of classroom observation and experience working with these teachers, this author would rate their apparent comfort with technology about the same as or slightly higher than they rated themselves.

The teachers were asked about their approach to instruction, i.e., what they saw as their role in student learning. Ann and Carol defined their role as facilitators. Betty referred to herself as a guide. Faye, on the other hand, referred to herself as a manager. All of the teachers stated that they used cooperative group work as part of their normal daily instruction. Diane and Faye said that they used cooperative group work either weekly or bi-weekly. Edith noted that she used computers more often after the beginning of Maya Quest.

Cooperative group work in a classroom is best facilitated by a desk arrangement that allows for ready communication. Within a week of starting the expedition, Edith had rearranged her classroom to four desk groupings.

Betty, Carol and Diane mentioned that they had attempted previous Classroom Connect quests with limited success, and Betty described her past experience (AmericaQuest 2000) as "overwhelming."

All teachers indicated that prior to MayaQuest their students used computers for word processing, i.e. journaling, letter writing, cooperative story writing and research reports; all took advantage of *Encarta Multimedia Encyclopedia* '97 and the Internet; and several used notebooks/TV connections for whole group demonstration.

Throughout the year Betty, Carol, Diane, Edith and Faye used Power Point presentations for morning announcements that were projected on the classroom TV. These included reminders of what the students should do when they arrived in the classroom, journal prompts, and learning center management. Several also created hyperlinked learning centers, for example, creating a single slide to explore electricity and magnetism by linking to several related websites (students rotated through the computers stations with this teacher created focus sheets).

Looking at these teachers' level of adoption of technology in reference to the ACOT model none, it is possible to place them loosely along the continuum of growth. Faye's instructional emphasis placed her in the adoption stage, whereas Anne, Carol, Diane and Edith style of instruction placed them at the Appropriation stage.

Student Outcome

Each of the teachers was asked to comment on student outcome, as a result of MayaQuest participation. Several noticed an increase in the students' independent use of technology. Students developed independent problem solving skills through use of the Mystery Photo. For example, the "Mystery Photo" is a picture of an object taken at close range so that its size and context are questionable Students were asked to guess, or infer, what it was with the least number of clues. Betty explained:

> "Of course, the kids love the Mystery Photo… We looked at it, we got our clues…and we still didn't have a clue what it was. But they knew it was some kind of plant. It said it wasn't a bush, so they guessed it was some kind of tree. And then it said something about ants. So, then I showed them how they could go into the Quest library and start looking for websites about plants and helped them to come up with what do we need to look for…We had to look in several places, and they found the tree. They couldn't WAIT to get over to the computer to write their answer…they'll call me over, I found it! I figured it out! Instead of them just guessing and seeing what the answer is, which is what mine did in the past because I didn't do it that way and show them how to find the answer. They're getting so much better at research skills, on the Internet sites, on the Encarta sites. They're skimming for information."

Increased student motivation was noticed by all of the teachers. Betty noted that her class would be so involved in what they were doing that they would forget to go to lunch. Anne, a third grade teacher, noted a student who had come into third grade barely reading at all who was able to read MayaQuest entries and "state five facts he'd read." She also stated that reading this type of text, i.e., expository text helps to "…train the reader's eye, to read for understanding."

Edith used words from the quest for the weekly vocabulary. Faye had observed her students reading the journal entries on the quest website and that "…they read through the text with vocabulary I know they don't know but continued to read anyway to get the gist of what they were saying."

Several teachers noted that learning curricular content in the context of the quest helped students to make connections to their learning. Betty and Carol used ecosystems as their focus. Betty said,

> "They're talking about producers. They're talking about consumers and …they're using it in conversation now. They read something about an animal…I guess it was about the termite eating rotten wood and I heard them say, 'Oh, so that's a decomposer.' They're making the connection."

All of the teachers commented on the importance of the realism and opportunities for decisions making that are part of the quest experience. Their participation in the quest

> "…was not just a scenario in a book. It's real. Someone's really talking to us and thinking we're important. They think that what we have to say matters. And these fourth graders, they feel so important. That they want to hear what their vote is and that they make a difference." [Betty]

The Kid Profile had a particular impact on their students. The students were most intrigued by Alfredo, a 9-year-old shoeshine boy in Guatemala who has lived on his own for 3 years (Buettner, 2001). These teachers did a compare and contrast activity comparing basic characteristics of their lives and Alfredo's. The difference was "stark," as Carol put it.

Table 2. Teacher Selected Curricular Focus for MayaQuest

TEACHER	Science	Social Studies	Math	Language Arts
Anne	Animal classification	Reading maps and charts, communities, compare/contrast	Gathering data, graphing	Expository writing, reading for facts
Betty	Ecosystems, food webs	Reading maps, charts, latitude & longitude, compare/contrast	Gathering data, graphing	Journaling, writing research reports
Carol	Ecosystems, food webs	Reading maps, charts, latitude & longitude, compare/contrast	Gathering data, graphing	Journaling, writing research reports
Diane	Animal classification, weather			Writing research reports
Edith	Animal classification, weather	Reading maps, charts, compare/contrast	Gathering data, graphing	Writing research reports
Faye		(Mentoring)		Reading expository text

Issues Surrounding MayaQuest Implementation

During the year of this study, teachers had access to 5 classroom computers, a teacher laptop and three mobile notebook computer carts available on sign out from the media center. When asked what would keep them from participating in future quests, Betty and Carol stated that access to the technology would be a major factor.

Table 2. Teacher Selected Curricular Focus for MayaQuest

All teachers mentioned the need to find a curricular focus for the quest (See Table 2). Several teachers felt pressure to meet the established curriculum and prepare for the standardized tests.

In response to this perceived pressure, however, some teachers noted that their students learned helpful content and skills in preparation for standardized testing. Betty noted that,"If I hit these objectives [the QCC's] through the quest, they're going to like it better…if I can find the right [curricular] focus I can do any quest."

Assessment of student outcome was an issue raised by several of the teachers, even though no question addressed it directly. "Can I assess all of their growth in understanding of the world, their communication? No!" [Anne] Portfolios, rubrics and use of the quest's on-line quizzes, however, were ways that most of the teachers measured student growth.

Discussion

Teacher and student response to the MayaQuest experience was uniformly positive. Teachers spoke excitedly about their students' response to the experience and about their own enjoyment with teaching with MayaQuest. Comments throughout the five weeks included how engaged the students were and how ordinarily reluctant learners were participating fully. They remarked that their students made connections between their newly introduced content skills and the quest experience. At the end of MayaQuest, all participating teachers agreed that it was a valuable experience that they plan to repeat the following school year.

The teachers in this study were all relatively experienced; even the least experienced had taught for four years (see Table 1). As a result, they had a good understanding of school culture, curriculum management, the Georgia QCC's, and basic classroom management. Their self-proclaimed comfort level with technology was relatively high. These teachers were well along the continuum of technology adoption as defined by Sandholtz, Ringstaff and Dwyer's model (1997).

All of the teachers said that given adequate resources, they would sign up for another quest. For these teachers, learning best takes place in an environment that is interdisciplinary, involves authentic problem solving, is collaborative and supports skill development. Some teachers have found previous quests to be overwhelming. However, once they determined a curricular focus, they looked at the quest's complexity more as a rich resource than a roadblock. Betty, Carol and Diane had tried previous quests. This certainly helped them with understanding what was involved. They all reviewed the teacher's guide thoroughly before starting and Anne said that this was key in her finding the focus for her instruction. Key to their final adoption of MayaQuest, and possibly future quests, was their 1) ability to reinvent or modify the experience to fit their instructional style and curricular needs and 2) the impact that it had on their students' academic growth.

Perhaps the most significant common instructional characteristic of these teachers was how they defined their role in student learning. They proclaimed themselves as facilitators focused on creating a learning environment for their students rather than simply imparting information or delivering curriculum. They actually verbalized a preference for an interdisciplinary approach to instruction, i.e. teaching in this manner helped students make connections across the curriculum.

Their classroom-learning environment regularly included student to student and student to teacher collaboration and cooperation. They recognized the classroom as a community of learners and organized student activities with that in mind daily.

All of the teachers used the classroom desktops, and Anne, Betty, Carol and Edith also used the student notebooks to support MayaQuest. Classroom student assistants, called TechnoBuddies, were responsible for pick up, setup, troubleshooting, break down and return of the notebook carts to the media center. They developed independence from daily technology use, which made it possible for the teacher to focus on facilitating the various classroom activities. In the classroom, students worked in pairs, or sometimes individually at the computer to interact with the MayaQuest web page, do research or publish their Power Point presentations, reports and journal entries. Because these teachers supported collaboration, their students' skills with both the technology and the content grew. The students frequently learned technical and content information from each other.

Key to the success of MayaQuest for these teachers was access to the technology. All but Diane and Faye noted that if they had not had access to the notebooks on a daily basis, that the impact of the MayaQuest experience would not have been as great. There was new information on the site daily, and because there was so much that was interesting, both the students and teachers felt a need to keep up with team's adventures. Daily access also allowed for students to respond daily to journal postings, continue research, draft, revise and produce quality responses to their learning. Missing a day was not a choice they wanted to make. When asked if they would do MayaQuest with just the five desktops in their room, the teachers said that they would, but felt that fewer students would be able to interact with the site daily or produce the same quantity or quality of work. As Betty said, "They have to touch it everyday or you lose them."

The teachers' view of students as part of a community of learners and their willingness to participate in MayaQuest demonstrated a broad view of education. They all had the established curriculum to teach and goals to meet but were flexible enough in their view of education to be able to blend these goals into the quest experience. Curricular focus was very important to their adoption of the quest, and as Betty stated, "If I can find the curricular focus I can do any quest."

The MayaQuest 2001 experience was an excellent example of anchored instruction. Students were placed in a learning environment, or macrocontext, that was truly authentic. They worked with a team of field experts over a period of time to find clues about the mystery of the fall of Mayan civilization, a complex problem with few clear answers. Students worked as practitioners. They shared their research and theories, collaborating not only with their classroom peers, but also with students around the world and with field experts. Considered part of the research team, their input was valued, which added to the authenticity of their participation.

The most significant outcome of the MayaQuest experience for these teachers was the impact that it had on student learning. According to the teachers, student response to MayaQuest was unanimously positive. Even students considered to be at risk, were excited enough by the content that they seemed to forget that they were reading, writing and doing mathematics. Teachers noticed increased scores on vocabulary tests, increased reading comprehension and writing production. Anne's third grader, a non-reader at the beginning of the year, was reading web site postings and able to state facts about what he'd read during the quest. All teachers noted that student critical thinking showed growth, as evidenced by improved problem solving and journal reflections.

The range of topics and the authenticity of the issues blurred the boundaries between mathematics, science, reading and so on. Aided by their teachers, and often independently, students made connections to curricular goals and applied new learning to a real context. Students meeting children through the Kid Profile were often moved by their counterparts' lifestyle and easily made connections to their own lives certainly developing a broader global view.

Implications

Those teachers who view themselves as classroom facilitators of student learning, take a flexible approach to instruction, have a clear direction in terms of curricular goals, and prefer to help students make connections to learning and real life through an interdisciplinary approach to learning, are more likely to adopt virtual quests. Teachers with well-developed and frequently used technology skills are also more likely to tie quests into curriculum goals. The results point toward these teachers as the best candidates for successful quest experiences.

Teachers, who participate in a virtual quest for the first time, might be encouraged to speak with other teachers who have participated in previous quests. Communication could happen through the Classroom Connect Quest Channel where previous and current quest bulletin boards are available for teachers.

The high level of student motivation, increase in student work production, and good work, cannot be ignored. It is the most exciting outcome of virtual quest participation. By their nature the quests' adventure, authenticity and interaction with the quest team in the field, are so engaging that students seem to learn without realizing it. The teachers in this study noted that the amount and type of reading that their students were doing, i.e. daily high level expository reading, writing, and the development of their students' critical thinking skills through quest activities, did more to prepare their students for standardized testing than did drill and practice. The students developed skills that were transferable to new academic settings.

Access to technology as part of virtual quest success was an issue brought up by teachers in this study. Although they had five networked multimedia desktops in their classrooms, four of them felt that the high level of student achievement was related to the daily use of the additional ten wireless notebook workstat ions. The implications are that teachers with less technology access will find quest implementation more challenging.

Further Research

The results of this study lead to some new questions for further research. First, would a larger sample of interviewees show the same teacher characteristics for quest participants? Second, would a sample of teachers who do not know the author provide different results?

The next step for this study would be to measure student outcome more quantitatively. How, and how much, does student achievement increase as a result of participation in a virtual quest? Student data on language arts, mathematics, science, social studies and critical thinking skills prior to and following quest participation would give data for comparative study. Standardized test scores of students participating in the quests might be compared to those who use drill and practice preparation.

Final Comments

This study demonstrates the value of the anchored instructional approach to learning, as represented by MayaQuest. Student participants in this study were highly engaged, motivated, and appeared to benefit from increased skill development and work production. Students experienced models of problem solving, teamwork, thought processes and language in an authentic manner, not just as a scenario developed to simulate reality. That authenticity was made possible by access to the technology, bringing the field experience into the classroom while transporting students to the field.

Adoption of virtual quests can motivate and rejuvenate teachers, but certain teachers are also more likely to adopt virtual quests. They are teachers who value a student-centered approach, view themselves as facilitators of learning, are flexible enough to modify the prescribed curriculum to fit the quest experience, and who are comfortable with technology.

Virtual quests are a promising instructional approach. It is not recommended that a school or district adopt them globally. Rather, teachers should be given the opportunity to adopt or not adopt virtual quests. It is also important that they be provided both technical and instructional support as needed. For the appropriately oriented teacher, anchored instruction, in the form of virtual quests, is a very exciting addition to the learning environment.

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Self-Efficacy and Self-Directedness: The Impact on Student Satisfaction in Distance Education Courses

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Abstract

A popular belief is that a learner's degree of self-directedness impacts the success of students learning at a distance Also conceivable is that self-efficacy may affect student satisfaction in distance courses. Additionally, satisfaction may help to identify success in distance education students. However, the relationship between these variables has yet to be explored. In the summer of 2001, subjects enrolled in web-based courses were surveyed to determine their self-directedness and self-efficacy and general satisfaction with their learning experience. Results of the statistical analyses and suggestions for future research are discussed.

Introduction

It is a widely held believe that a learner's degree of self-directedness plays a role in the success of students learning at a distance (e.g. Kearsley, 1995, Major & Levenburg, 1999, Moore, 1986). It is also thought that perceived self-efficacy may have an effect on student satisfaction in distance courses (Clark, 1999, Schneider & Reinhart, 1995). Additionally, satisfaction may be important in identifying future success of distance education students (Simonson et al, 2000).

The relationship between these three variables has yet to be explored. In particular, the relationship between perceived self-efficacy, self-directedness and satisfaction in a web-based course may play a major role in whether or not a student enrolls in courses at a distance, continues with study in a on-line degree program or recommends such courses/programs to other students. This could have far-reaching implications for distance degree programs and administration considering such programs.

Purpose of the Study

There were several purposes for this study. The first was to determine whether there is a relationship between perceived self-efficacy and self-directedness in students enrolled in an on-line Masters program. A second purpose was to ascertain whether there was a relationship between perceived self-efficacy and satisfaction. The third purpose was to determine whether there is a relationship between self-directedness and satisfaction. The fourth was to discover whether either perceived self-efficacy or self-directedness played a role in student satisfaction.

Subjects

Subjects were graduate-level students enrolled in two separate web-based courses: "Foundations of Instructional Technology" and "Advanced Technology in HPER" (Health, Physical Education and Recreation). Subjects in Foundations of Instructional Technology are working toward a Master of Science in Instructional Design and Technology. Subjects in Advanced Technology in HPER are working toward a Master of Science in Health, Physical Education and Recreation. Both Masters programs are fully on-line degree programs at the same midwestern university. Both classes are taken near the beginning of coursework in each respective major.

Methodology

The survey was a combination of three separate assessments: a perceived self-efficacy psychometric instrument (Jerusalem and Schwarzer), a self-directedness questionnaire (Guglielmino) and a survey designed to measure satisfaction with the subject's own learning and satisfaction with the learning environment (Summerville). Subjects were surveyed in the fifth week of a six-week summer course. Subjects were sent an e-mail message requesting that they take a survey to help future students who take courses at a distance. This survey consisting of eighty-eight individual items.

Instrumentation

The Generalized Self-Efficacy Scale

The Generalized Self-Efficacy Scale is a 10-item survey designed in 1981 by Jerusalem and Schwarzer to assess perceived self-efficacy. It was originally developed in the German language and subsequently translated into thirteen different versions. The measure was tested for each version and the Chronbach alpha for the English version was .90. It is available on-line at http://userpage.fu-berlin.de/~health/selfscal.htm.

Self-Directed Learning Readiness Scale

The Self-Directed Learning Readiness Scale was designed by Guglielmino to measure a subject's readiness to engage in self-directed learning. The SDLRS has been used by hundreds of organizations, translated into more than 14 languages and used in more than 90 dissertations since its development in 1977. Permission was given by the author to use the survey in an on-line format. This researcher tallied the number of surveys received and the author received compensation for each survey completed by the subjects.

Summerville Satisfaction Questionnaire

A satisfaction questionnaire was developed for administration in a doctoral dissertation (Summerville, 1997) and adapted for use in this study. Questions were designed to determine if students were satisfied with the learning environment, were comfortable with the learning environment, and to self-assess learning from the experience. For every question, an equal and opposite question was written to ascertain which wording best asked the question to be answered (e. g., "I liked learning via the Internet" vs. "I did not like learning via the Internet"). Two statistical consultants evaluated the questions for face and construct validity. These questions were then pilot tested with a group of approximately sixty subjects and subsequently scored to determine how effective the instrument was at measuring satisfaction. Finally, the completed satisfaction instrument was subjected to a Cronbach's Coefficient Alpha and a factor analysis to establish statistical validity and reliability. The resulting Coefficient Alpha for the satisfaction questionnaire was .89.

Data Collection

Data collection began during the fifth week of a six-week summer course. The subjects were sent an e-mail message detailing the purpose of the study, requesting subject participation and the message included the URL of the combined survey. Due to the agreement reached with the author of the Self-Directed Learning Readiness Scale, the subjects were given 48 hours to complete the survey before it was removed from Internet. The surveys were returned by CGI server to the researcher via e-mail. There were twelve useable surveys returned.

Analysis Procedures

Returned surveys were collected and data was coded for analysis by this researcher. SPSS Statistical software was used for analysis. Due to the unknown relationship between The Generalized Self-Efficacy Scale, the Self-Directed Learning Readiness Scale, and the Summerville Satisfaction Questionnaire, a Pearson Correlation was used for analysis on the total scores for each subject on each instrument to determine if there was a correlation between the instruments. If a relationship was found, a stepwise regression procedure would be used to determine if either the Generalized Self-Efficacy Scale or the Self-Directed Learning Readiness Scale impacted satisfaction.

Analysis of Pearson Correlation

A Pearson Correlation procedure was used to determine if there was a relationship between total scores on the perceived self-efficacy, self-directedness and satisfaction instruments, as measured by the combined survey. The result of the procedure is as follows:

		Perceived Self-Efficacy	Self-Directedness	Satisfaction
Perceived Self-Efficacy	Pearson Correlation	1.000	.770**	.322
	Sig. (2-tailed)	.	.003	.308
	N	12	12	12
Self-Directedness	Pearson Correlation	.770**	1.000	.577
	Sig. (2-tailed)	.003	.	.050
	N	12	12	12
Satisfaction	Pearson Correlation	.322	.577*	1.000
	Sign. (2-tailed)	.308	.050	.
	N	12	12	12

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Analysis of Stepwise Regression

ANOVA from the Regression Model for Independent Variable Self-Directedness and Dependent Variable Satisfaction

Model	SSQ	DF	MSQ	F
Regression	253.572	1	253.572	4.978*
Residual	509.344	10	50.934	
Total	762.917	11		

*Denotes significance at 0.05 level

Perceived self-efficacy was not found to be a significant predictor of satisfaction in this model.

Future Research

Since there was a significant correlation between self-directedness and student satisfaction and degree of self-directedness was found to be a significant predictor of student satisfaction, this researcher plans to investigate the relationship further. Additionally, since perceived self-efficacy and self-directedness were so highly correlated, the relationships between those variables will also be investigated to a greater degree.

In particular, this researcher plans to survey other students enrolled in on-line courses but use a different schedule for survey administration. The perceived self-efficacy and self-directedness surveys will be administered at the beginning of the semester while and the perceived self-efficacy survey will be readministered and satisfaction survey will be administered at the end of the course.

In the future, this researcher plans to develop prescriptions for helping students with low perceived self-efficacy and/or low self-directedness scores have a greater degree of satisfaction with their own learning. Additionally, the relationship between satisfaction and achievement may also be explored and, if warranted, prescriptions will be developed for students with difficulty in these areas.

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Characteristics of Job Corps Students: Their Relationship to Training Completion and Job Placement

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Abstract

This study examined the learner characteristics of enrollees in the Job Corps training program. The independent variables in this study were length of time out of school, age, gender, ethnicity, and scores on the Tests of Adult Basic Education (TABE). The dependent variables were training completion, job placement and training completion time. Research questions investigated the relationship between the independent and dependent variables. Data for all variables was obtained from the US Department of Labor, and represented 70,049 enrollees from July 1, 1996 through July 1, 1997.

Results of the study indicate older students who have more training prior to enrolling in the Job Corps and those who score higher on the TABE have higher training completion and job placement rates. Success in these two outcome variables was achieved by over half of all enrollees. The strongest finding of the study is the impact of literacy training on the outcomes under investigation.

Identification of learner characteristics is a prominent step in various instructional design models (e.g., Dick and Carey, Reigeluth, Jonassen and Hannum, Morrison, Kemp & Ross). Despite this step being emphasized, a review of the literature in the field of Educational Technology reveals very few studies in this area. Recommendations for further research are included.

Overview

Instructional design experts have consistently advocated the investigation of learner characteristics prior to the design and development of instruction so that these characteristics can inform the design process. In this study, the researchers investigated learner characteristics of at-risk learners enrolled in a large, federally funded vocational training program, the Job Corps, to determine if a relationship existed between certain learner characteristics and student success in the program. The researchers examined extant data related to learner characteristics that is routinely collected by the Job Corps when students enter the program. The intent was to determine which of these characteristics were related to success in the Job Corps vocational training program.

Instructional design models typically provide information on examining learner characteristics. It is one of the early steps in the Dick and Carey (2000) instructional design model, a model widely used in the field of Educational Technology. The authors provide much detail related to gathering and analyzing learner characteristics, and how these characteristics should then drive the design of instruction. This need to have learner characteristics serve as the basis for instructional design is echoed by Reigeluth (1999), Jonassen and Hannon (1995), Morrison, Kemp & Ross (2001), as well as many other instructional design experts.

Purpose of the Study

The purpose of this study was to examine the characteristics of at-risk learners who participated in the U.S. Department of Labor's Job Corps program. The independent variables in this study were those characteristics the student had upon entering the program as collected by the Job Corps. These variables were: (a) length of time out of school, (b) age of the student upon entering the program, (c) gender, (d) ethnicity, and (e) entry-level academic skills as measured by the Tests of Adult Basic Education (TABE). The dependent variables were: (a) whether the student completed the training (training completion), (b) whether the student was placed in a job (job placement), and (c) the length of time students took to complete the program (training completion time).

Review of the Literature

The at-risk adult learner has many obstacles to success: traumatized, often unstable backgrounds, low literacy levels, and a lack of faith in the educational system being able, or willing to meet their needs. The negative impact of these obstacles is the limitation of economic achievement for this group.

The workplace qualifications of at-risk adults are in stark contrast to the needs of business. Gone are the days of low-level jobs where minimal skills were acceptable. The current and future needs of business call for literate workers who can function as a part of a team, who can access and analyze information, and who can function independently with little supervision.

In order for at-risk learners to participate in the workplace of the future, they require remedial training in basic skills and vocational training. This training cannot effectively take the form of traditional training, for the traditional style of training has failed this group in the past. A different educational setting is required that can accommodate the unique needs of this group, where the instruction is individualized and self-paced, yet structured and supportive. The Job Corps provides this kind of opportunity.

Research Questions and Methodology

The Job Corps was chosen for this study because it targets youths who are economically and educationally disadvantaged. Job Corps training centers offer basic education leading to a high school diploma or GED and vocational skills training. The 70,049 records used in this study represented all Job Corps enrollees from July 1, 1996 to July 1, 1997. Data for the study were supplied by the U.S. Department of Labor. There were five research questions that guided this study:

1. Do length of time out of school, age, gender, ethnicity and entry-level academic skills as measured by scores on the Tests of Adult Basic Education (TABE) in English and math discriminate between Job Corps students who complete training and Job Corps students who do not complete training?
2. Do length of time out of school, age, gender, ethnicity and entry-level academic skills as measured by scores on the Tests of Adult Basic Education (TABE) in both English and math discriminate between Job Corps students who are placed in jobs and Job Corps students who are not placed in jobs?
3. Is there a relationship between length of time out of school, age, gender, ethnicity and entry-level academic skills as measured by scores on the Tests of Adult Basic Education (TABE) in both English and math for Job Corps student who differ on training completion time?
4. Is there a relationship between the Tests of Adult Basic Education (TABE) English scores and training completion, job placement, and length of time to complete training?
5. Is there a relationship between the Tests of Adult Basic Education (TABE) math scores and training completion, job placement, and length of time to complete training?

The first two questions were investigated using discriminate analysis. Research Questions 3, 4 and 5 were investigated using multiple linear regression.

Results

The results of the discriminate analyses for Research Questions 1 and 2 indicated that the five independent variables were all predictive of students completing training and being placed in jobs. The results of multiple linear regression for Research Questions 3, 4, and 5 indicated significant relationships between all of the independent variables and training completion time. In other words, significance was found for all independent variables in their relationship with the dependent variables in this study.

Discussion of the Results

In this study the most important learner characteristic to emerge was literacy level. Many at-risk individuals are unable to secure jobs paying more than minimum wage because they don't have the literacy levels to understand business documents. Business documents can be written memos, training manuals, reference lists, emails, inventory documents and financial statements. Communication flounders when literacy skills are weak or missing. Poor communication skills negatively impact success in the workplace.

The data indicated that enrollees who scored 600 or more on the TABE English or math tests were more likely to complete training. This group, functioning at the 2nd grade literacy level, possesses some foundational skills that can be enhanced through remediation. The results of this study also contradict a common misconception that if a people cannot read by the third grade, they are probably unwilling or unable to learn. As Knowles stated, people learn when the training is relevant. By combining vocational training and literacy training, the Job Corps establishes this relevance.

One issue regarding high school diplomas or GEDs and their relationship to literacy is necessary to understand the success of the Job Corps program. The presence of a diploma or GED does not necessarily mean that the student is highly literate. At the Job Corps all enrollees are tested, and if an enrollee has a high school diploma or equivalency and still scores below the 8th grade 5th month on the TABE, remediation is prescribed. It might be worth stating the 8th grade 5th month literacy level is important because that is the level at which most business correspondence is conducted. Newspapers, popular magazines, government forms, publications, and other types of documents are written at this level. Other programs with which this researcher is familiar do not strive to move the literacy level of program participants to this 8.5 level which is typically required to be successful in the workplace. As a result, it can be inferred that one of the hallmarks of the Job Corps success is the fact that students complete the program with a solid literacy level required by employers.

The Job Corps is not currently training knowledge workers. It may be necessary for this program to examine what it would take to train individuals to compete in the new economy. Certainly, higher literacy levels and problem solving skills are necessary in order for Job Corps participants to gain entry into the knowledge workforce. This workforce commands higher salaries which in turn contribute to a higher standard of living. In the future, the Job Corps program may want to consider raising their literacy standards and provide the training necessary to produce knowledge workers.

The Job Corps, through testing and remediation, stands as an excellent example of how learner characteristics can be exploited at the front end of a training program in order to achieve success at the end of a training program. The future success of the Job Corps program may hinge on its ability to produce knowledge workers for the new economy.

Recommendations for Further Research

The identification of learner characteristics needs to be more rigorously addressed. Variables examined in this study are those collected by the Job Corps and are demographically oriented. Case studies might reveal additional learner characteristics not discussed in this study. One possible method would be to select several Job Corps enrollees with different entry skills and literacy levels and conduct a series of comparative case studies. These could include thick descriptions of their experiences in the training program and how their learner characteristics impact these experiences. Observations, interviews, identifying key informants--perhaps instructors or mentors involved closely with the subjects--as well as journal records and demographic data could be used as data sources for the case studies.

One aspect of particular interest to this researcher is the residential component of the Job Corps, and its effect on training completion. There are several day program sites in the Job Corps where enrollees report every day to training as they would to a job. A study that might be informative from a program design standpoint would compare a residential program with a day program to see whether there is a difference in their impact on success.

Several longitudinal studies are suggested by the results of this research. Studies could be designed to compare programs that emphasize literacy training with programs which do not emphasize literacy training. How do their program participants fare over time? Are there comparable job placement rates? Are wage rates comparable? Again, the long-term employment outcomes of participants may provide information that could then be used to enhance program design.

Conclusions

The independent variables in this study--length of time out of school, age, gender, ethnicity and scores on the Tests of Adult Basic Education in English and math--were examined to determine if a relationship exists between those characteristics and training completion, job placement and length of training. Data provided by the US Department of Labor contained records for 70,049 enrollees who participated in the Job Corps from July 1, 1996 through June 30, 1997. The relationships between these variables were tested using discriminate analysis and multiple linear regression. Results of these statistical tests indicate a relationship between entry characteristics and training completion. The data also highlights the importance of combining literacy training with vocational training, especially for those individuals who have been classified as at-risk because of their low literacy skills.

The data in this study support the importance of investigating learner characteristics and allowing that knowledge to drive the program design. A review of literature reveals an acute shortfall of studies that investigate learner characteristics and their impact on program design. This researcher recommends that practitioners of instructional design focus more attention on this aspect of the design process.

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Instructional Design Issues Facing E-Learning: East Meets West

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Abstract

The rapid emergence of e learning in business and industry has been accompanied by a number of problems when instructional design concerns are incorporated into the overall curriculum development.

This paper examines two distinct geographical extremes of Shin-Ju, Taiwan and Central Florida to see if, when comparisons are made, there appear any issues in common to both locations and cultures.

Background:

The first company is located in Shin-Ju, Taiwan. It is one of many diverse high tech manufacturing companies located in the Shin-Ju Science Center. The major manufactured products are computer components. Their clients range from distribution channels in Taiwan and beyond on a worldwide basis. There are several thousand employees at the Shin-Ju location, with the following workforce demographics:

Males: 60% Females: 40%
Nationality: 100 % Taiwanese
Average Employee Age: 28
Average number of years employed at the company: 1-2 years
Average education level of employees: Bachelor's degree

The second company is in Lake Mary, Florida with corporate headquarters in Germany.
There are several thousand employees located at the Lake Mary plant with the following demographics:
Males: 60% Females: 40%
Nationality: Diverse, i.e. Hispanic, American-born Caucasian, African-American, Asian, Northern European, etc. with a majority being American-born Caucasian.
Average Employee Age: 34
Average number of years employed at the company: 5-10 years
Average education level of employees: High School diploma-Two year's college
The Florida corporation has ISO 9000 Certification.

The Taiwanese company has a top-down management style that maintains stringent accountability and performance standards. Employees have a three-shift daily 24-hour production line quota that is enforced. If the production line fails to meet piecework numbers and a random sampling of quality levels exceeds a specified percentage, the line is shut down until the problem is corrected.

The Florida company tolerates a specified percentage of rework numbers and, should this number increase beyond tolerances management is on the floor investigating the cause. The management structure reflects a "Northern European" work ethic relative to stringent cleanliness, time on and off the clock, and attention to detail. It is also top down but participatory in nature.

The Issues and Statement of the Problem

In the Shin-Ju company two basic quality management tools are in place to assist in the efficient operation of the plant. These tools are: Quality Control Seven Tools (QC 7) which involves analysis of tasks related to Zero Defects, Significant Milestones, Statistical Process Control, etc. and a Failure Mode Effectiveness Analysis (FMEA) table that tracks and analyzes production line failure.

The Florida company bases its analysis on identified ISO 9000 standards for quality control of all production line task rates. In both instances, management mandates the use of both analysis tools and production standards and the degree to which they are actually used in practice varies considerably.

Degrees of variance relate to the employee's understanding of the necessity to use such tools, their perception of value in using them, and the inherent motivation accorded the employee. Courses on how to use the management tools were unsuccessful. During formal classes offered as to how to use the tools, it was found both management and production line employees did not understand them.

A Potential Solution

In both companies, employee training as a possible solution the problem was addressed. It was felt that if sufficient training could be provided, the management tools already in place would be used.

The Taiwan organization has been provided with a curricular plan based on a new instructional design model devised by the lead author through a series of formulae and matrices that, once training elements are identified, provide management with a specific action plan.

The Florida organization began its training analysis by first looking at its workforce demographics and capabilities. A first step was the provision of basic communication and mathematic skills for the line-workers, thus the beginning of *"Project Gold"*.

Issues from the East

This project focused on updating training needs and building a web based learning support system. A year after the system was adapted in this manufacturing company a reduction was found the number of employees who participated in web-based training. Each employee is required to take at least take one course via web based training but many finally quit learning from the web.

An interview and survey was conducted about the web based training issues from employee and management. It was found that employees are willing to participate in web training courses, the Internet access is good, and each course is well designed. The connection between courses was the problem. For example, in the quality control class, learners did not have the requisite statistics back ground to successfully complete the class. When the employees enrolled in the quality control class, there was no English class provided to assist learners in reading the English menu or to operate machines that have English control panels.

Finding the training needs

The worker-oriented, job-oriented, and cognitive task analyses were performed as tools for determining the required skills, knowledge, and abilities of employees to accomplish the required tasks and for developing the training curriculum.

Worker-oriented Task Analysis

The purpose of the worker-oriented task analysis is to determine the knowledge and skills of employees. The process of worker-oriented task analysis includes interviews and discussions with employees, job tasks performance observations, review of tasks by management, and surveys to specify the knowledge and skills needed for accomplishing tasks (Clifford 1994).

Job-oriented Task Analysis

Job-oriented task analysis is used to collect procedural knowledge related to specific tasks required for each job. This analysis relies on employees and supervisors who can clearly state the job task sequence step-by-step (Texas Higher Education Coordinating Board 1995).

Cognitive Task Analysis

Cognitive task analysis involves observation and worker interviews and is a process used to gather information on worker behavior in problem solving (Llorente 1996).

The second focus of the project was building a web based learning support system that constructs a cognitive map to depict the amount of training needed. The training offered on the web contains approximately 2000 courses such as statistical process control, quality control tools, and specialized problem-solving skills and skill required for machine operations. The "map" is able to help learners to obtain direction as to the large number of courses, and shows both the pre-requisite and advanced courses.

The core principle of the learning support system

The learning support system employs characteristics found in our Interpretive Structure Model. "The Tangible product of an Interpretive Structure Model exercise is a structural model called a "map" which is, in general, a multilevel structure. In condensed form, the structure is a hierarchy" (Warfield, 1977). From the cognitive map learners have a visualized concept that shows the course structure and the hierarchy of courses, thus enabling learners to track their learning path and direction without getting lost. The following information illustrates the core principles that allow the computer to automatically develop the graphic structure of training courses.

Step one: Determine the training needs.

From the figure 1, the "1" represents the specific department and the following 1.1, 1.2, 1.3, 1.4 numbers represent the four assembling lines under department "1". Training needs determined through worker, job, and cognitive task analyses, are depicted as Q_1, Q_2, Q_3…Q_{ijk} as shown in figure 1.

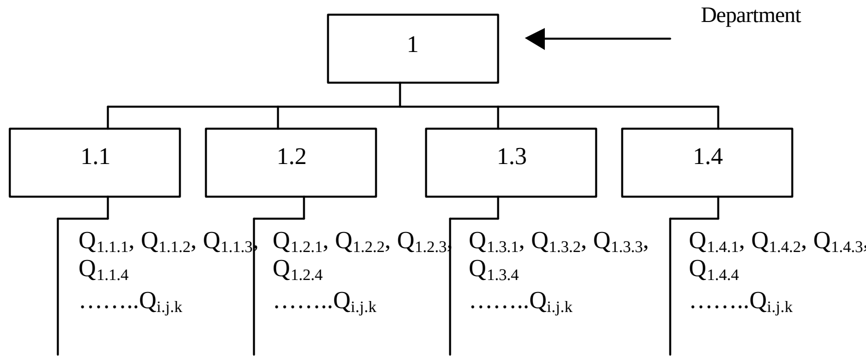

Fig. 1. Needs assessment

Step two: Forming the system matrix

This step compares every course or learning objective with every other course or learning objective in the matrix to identify any subordinate relationships. When completed, a system matrix that embodies the subordinate relationships between and among the courses and learning objectives is the result.

No.	Course Course	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Q1						?								
2	Q2	?					?								
3	Q3	?	?		?		?		?						
4	Q4	?	?				?					?			
5	Q5			?						?					
6	Q6														
7	Q7												?		
8	Q8			?		?				?					?
9	Q9										?		?		
10	Q10														?
11	Q11									?	?				?
12	Q12														
13	Q13									?					?
14	Q14									?	?		?		

Fig. 2. System matrices

Step three: The rationalizing procedure. The system matrix is then transferred to connected matrices.

This step is intended to determine the number of system matrix hierarchies. The aim of the rationalizing procedure is to produce a set of matrices called *connected subordination matrices*, each of which represents one hierarchy.

$$A = \begin{bmatrix} 0&0&0&0&0&1&0&0&0&0&0&0&0&0 \\ 1&0&0&0&0&1&0&0&0&0&0&0&0&0 \\ 1&1&0&1&0&1&0&1&0&0&0&0&0&0 \\ 1&1&0&0&0&1&0&0&0&0&1&0&0&0 \\ 0&0&1&0&0&0&0&0&1&0&0&0&0&0 \\ 0&0&0&0&0&0&0&0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&0&0&0&0&0&1&0&0 \\ 0&0&1&0&1&0&0&0&1&0&0&0&0&1 \\ 0&0&0&0&0&0&0&0&0&1&0&1&0&0 \\ 0&0&0&0&0&0&0&0&0&0&0&0&0&1 \\ 0&0&0&0&0&0&0&0&1&1&0&0&0&1 \\ 0&0&0&0&0&0&0&0&0&0&0&0&0&0 \\ 0&0&0&0&0&0&0&0&1&0&0&0&0&1 \\ 0&0&0&0&0&0&0&0&1&1&0&1&0&0 \end{bmatrix}$$

Step four: Transfer connected matrices to reachable matrix

Definition $B = A + I$

Where A = Connected matrices

I = Identity matrices

[Boolean factor]

0+0=0 0x0=0
0=1=1 0x1=0
1=0=1 1x0=0
1=1=1 1x1=1

reachable matrix

$B.B....B^{n-1}=B^n$

reachable matrix: $T = B^n$

[Generating matrix]

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix} \times \begin{bmatrix} a' & b' \\ c' & d' \\ e' & f' \end{bmatrix} = \begin{bmatrix} a \cdot a' \oplus b \cdot c' \oplus c \cdot e' & a \cdot b' \oplus b \cdot d' \oplus c \cdot f' \\ d \cdot a' \oplus e \cdot c' \oplus f \cdot e' & d \cdot b' \oplus e \cdot d' \oplus f \cdot f' \\ g \cdot a' \oplus h \cdot c' \oplus i \cdot e' & g \cdot b' \oplus h \cdot d' \oplus i \cdot f' \end{bmatrix}$$

Generating matrix:

$$B = A + I = \begin{bmatrix}
0&0&0&0&0&1&0&0&0&0&0&0&0&0\\
1&0&0&0&0&1&0&0&0&0&0&0&0&0\\
1&1&0&1&0&1&0&1&0&0&0&0&0&0\\
1&1&0&0&0&1&0&0&0&0&1&0&0&0\\
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0&0&0&0&0&0&0&0&1&1&0&1&0&0
\end{bmatrix} + \begin{bmatrix}
1&0&0&0&0&0&0&0&0&0&0&0&0&0\\
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0&0&0&0&0&0&0&0&0&0&0&0&1&0\\
0&0&0&0&0&0&0&0&0&0&0&0&0&1
\end{bmatrix}$$

$$= \begin{bmatrix}
1&0&0&0&0&1&0&0&0&0&0&0&0&0\\
1&1&0&0&0&1&0&0&0&0&0&0&0&0\\
1&1&1&1&0&1&0&1&0&0&0&0&0&0\\
1&1&0&1&0&1&0&0&0&0&1&0&0&0\\
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0&0&0&0&0&0&0&0&1&1&0&0&0&0\\
0&0&0&0&0&0&0&0&0&1&0&0&0&1\\
0&0&0&0&0&0&0&0&1&1&1&0&0&1\\
0&0&0&0&0&0&0&0&0&0&0&1&0&0\\
0&0&0&0&0&0&0&0&1&0&0&0&1&1\\
0&0&0&0&0&0&0&0&1&1&0&1&0&1
\end{bmatrix}$$

$$B^5 = B \times B = \begin{bmatrix}
1&0&0&0&0&1&0&0&0&0&0&0&0&0\\
1&1&0&0&0&1&0&0&0&0&0&0&0&0\\
1&1&1&1&1&1&0&1&1&1&1&1&0&1\\
1&1&0&1&0&1&0&0&1&1&1&1&0&1\\
1&1&1&1&1&1&0&1&1&1&1&1&0&1\\
0&0&0&0&0&1&0&0&0&0&0&0&0&0\\
0&0&0&0&0&0&1&0&0&0&0&1&0&0\\
1&1&1&1&1&1&0&1&1&1&1&1&0&1\\
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0&0&0&0&0&0&0&0&1&1&1&1&0&1\\
0&0&0&0&0&0&0&0&0&0&0&1&0&0\\
0&0&0&0&0&0&0&0&1&1&0&1&1&1\\
0&0&0&0&0&0&0&0&1&1&0&1&0&1
\end{bmatrix} = \quad T \text{ (reachable matrix)}$$

Step five: Transform reachable matrix to hierarchical matrix
[Definition]
$s_{i:}$ the number of the element
$R(s_i)$ reachable set
$Q(s_{i)}$
$R(s_{i)}\ Q(s_{i)}$
[Example]
$s_i = 1$
$R(s_{i)}$: 1 6
$Q(s_{i):}$ 1 2 3 4 5 8
$R(s_{i)}$ n $Q(s_i)$: 1

	s_i	$R(s_i)$	$Q(s_i)$	$R(s_i)$ n $Q(s_i)$
Level1	1	1 6	1 2 3 4 5 8	1
T	2	1 2 6	2 3 4 5 8	2
	3	1 2 3 4 5 6 8 9 10 11 12 14	3 5 8	3 5 8
	4	1 2 4 6 9 10 11 12 14	3 4 5 8	4
	5	1 2 3 4 5 6 8 9 10 11 12 14	3 5 8	3 5 8
	6	6	1 2 3 4 5 6 8	6
	7	7 12	7	7
	8	1 2 3 4 5 6 8 9 10 11 12 14	3 5 8	3 5 8
	9	9 10 12 14	3 4 5 8 9 10 11 13 14	9 10 14
	10	9 10 12 14	3 4 5 8 9 10 11 13 14	9 10 14
	11	9 10 11 12 14	3 4 5 8 11	11
	12	12	3 4 5 7 8 9 10 11 12 13 14	12
	13	9 10 12 13 14	13	13
	14	9 10 12 14	3 4 5 8 9 10 11 13 14	9 10 14
Level2 T'	1	1	1 2 3 4 5 8	1
	2	1 2	2 3 4 5 8	2
	3	1 2 3 4 5 8 9 10 11 14	3 5 8	3 5 8
	4	1 2 4 9 10 11 14	3 4 5 8	4
	5	1 2 3 4 5 8 9 10 11 14	3 5 8	3 5 8
	7	7	7	7
	8	1 2 3 4 5 8 9 10 11 14	3 5 8	3 5 8
	9	9 10 14	3 4 5 8 9 10 11 13 14	9 10 14
	10	9 10 14	3 4 5 8 9 10 11 13 14	9 10 14
	11	9 10 11 14	3 4 5 8 11	11
	13	9 10 13 14	13	13
	14	9 10 14	3 4 5 8 9 10 11 13 14	9 10 14
Level 3 T'	2	2	2 3 4 5 8	2
	3	2 3 4 5 8 11	3 5 8	3 5 8
	4	2 4 11	3 4 5 8	4
	5	2 3 4 5 8 11	3 5 8	3 5 8
	8	2 3 4 5 8 11	3 5 8	3 5 8
	11	11	3 4 5 8 11	11
	13	13	13	13
Level 4	3	3 5 8	3 5 8	3 5 8
T'''	4	4	3 4 5 8	4
	5	3 4 5 8	3 5 8	3 5 8
	8	3 4 5 8	3 5 8	3 5 8
Level 5	3	3 5 8	3 5 8	3 5 8
T	5	3 5 8	3 5 8	3 5 8
	8	3 5 8	3 5 8	3 5 8

Fig. 3. Hierarchy Analysis

Step six: Transform the hierarchy matrix to the Interpretive Structure Model

In this step the task is to produce a cognitive map and graphic hierarchy structure among courses or learning objectives. After this step, the "map" automatically generates by computer and is displayed on the web page. Learners will have a visualized concept on the course structure and the hierarchy of the course and be able to track their learning path and direction without getting lost.

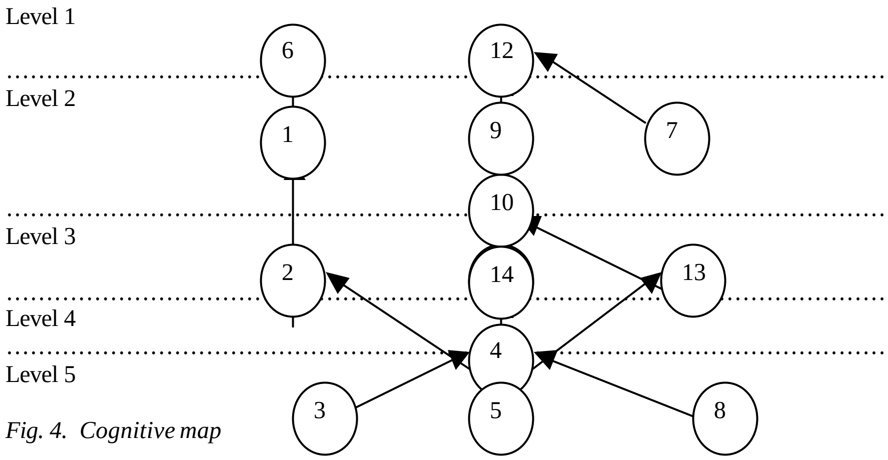

Fig. 4. Cognitive map

Issues from the West

The global corporate climate in which American businesses find themselves competing today requires a high workplace rich in skills and technology. Today's manufacturing workforce requires continual training to keep abreast of technological advances. Today's corporations need flexible people, trained in many different functions (specialized training with cross training).

Technology waits for no one! It is progressing at warp speed, and workers (especially production workers) are hard pressed to keep up. Multinational manufacturing companies are working toward gaining or retaining global standardization of product quality (ISO 9000,QS 9000, etc). What happens to a worker with low basic skills and an inability to train rapidly enough to keep pace with these changes? They are lost during downsizing or merger. It is usually the least educated workers in low-end manufacturing jobs that become unemployed first and remain so for the longest amount of time. While many people consider the 1990-1991 recession to have been the first white-collar one, it hit minorities and low-skilled workers especially hard. They ended up getting clobbered and the least educated employees got clobbered once again. (Hilsenrath, September 2001)

A survey by the Gallup Organization for the National Federation of Independent Business found that two-thirds of companies of the 260 polled said they have gone without needed skilled employees. More than half said they had to cut work hours, limit production or turn away business. Many companies have told researchers that the softening market now allows them to be more selective in hiring than they were last year. (Grimsley, August 2001) Most organizations agree that letting less-productive workers go and replacing them with better-skilled ones during a time of economic crisis is an opportunity they are quick to use to their advantage. Current employees are increasingly aware of this situation.

Management Plays a Vital Role In Training

Management plays a vital role in for it sets the tone when it comes to employee training and professional development. Management teams of many American companies have already begun to align their training programs with the company goals and to follow the human resource management practice continuums. They are attempting to progress from short to long-term term focus, from narrow to broad application, from a productivity emphasis to quality of work life emphasis, from spontaneous, unplanned training to a planned, systematic one, from individual orientation to group orientation, from low participation to high participation and from zero employee involvement to a higher degree of involvement. (Evans & Lindsay, 1999, pp. 290-3)

In America companies, motivational focus is usually on rewards and recognition. They establish minimums for promoting cooperation, create or modify recognition systems, compensation systems, and mechanisms for broadening employee responsibilities. They create education and training opportunities for employees to learn and use skills that go beyond current job assignments through the redesigning process. They form relationships with educational institutions to continue to develop employees – thus, ensuring a supply of well-prepared employees. They actively seek employee involvement. However, depending on the type of management in the organization, the degree of employee involvement varies widely. The table below depicts levels of employee involvement. *

Level	Action	Primary Outcome
1. Information sharing	Managers decide – then inform employees	Conformance
2. Dialogue	Managers get employee input - then decide	Acceptance
3. Special problem solving	Managers assign problem to specific employees	Contribution
4. Intragroup problem solving	Intact groups meet to solve it.	Commitment
5. Intergroup problem solving	Cross-functional groups solve problems	Cooperation
6. Focused problem solving	Intact groups deepen involvement in specific issue	Concentration
7. Limited self-direction	Teams function full time with Supervision	Accountability
8. Total self-direction	Executives facilitate self-management in All-team Company	Ownership

*Source: Copyright@ Jack D. Orsburn, Linda Moran, Ed Musselwhite, and John H. Zenger, Self-Directed Work Teams (Burr Ridge, IL: Business One Irwin, 1990), p. 34. All rights reserved.

Increased employee involvement results in empowered employees who have the wisdom to know what to do and when to do it, possessing both the right motivation and tools. This requires significant change in work systems within companies. Employees must be provided education, resources, and encouragement from management. However, empowerment also means that managers must be willing to relinquish some power. This power shift often creates fears in management that workers will abuse their privileges. Experience usually shows that front-line workers generally are more conservative than their managers. (Evans & Lindsay, 1999, pp. 290-3)

Experience has shown that feedback to management is vital from the facilitator or educational institute providing the training,. With computer-assisted instruction and e-learning, this task is easier because monthly reports on employee training progress (generic progress – all names and vital information are omitted) can be sent to management on a regular basis.

Employee Motivation Plays an Important Role in Training Programs

Students in basic skills updating training programs report an immediate boost in self-esteem. As they set and meet goals, it is not long until a habit is formed and transferred to their own lives in the workplace and at home. Facilitators report comments such as, from an older student, "I enjoy coming to class because it helps me stay more mentally alert". Students realize that they get increased respect at home because they are now able to help their children with their homework. Supervisors report seeing an increased confidence and professional development focus that soon becomes an incentive to volunteer for additional training or responsibilities. Motivation for specific skill training is easier to generate because once employees comprehend "what's in it for them" they are excited about learning.

In order to motivate employees and managers of an organization, trainers or facilitators must establish a sound professional relationship with the company management and patiently attempt to spark the interest of the workers. Listening and being sensitive to their needs can aid in this task. If it is a manufacturing firm, understand that downtime is money lost. Being open to creative scheduling can be a big help – both for meetings with management and classes. Motivational flyers and pamphlets can be produced and strategically placed around the plant and open houses can be held with specific times set aside for questions and answers.

Examples of Successful Training Programs

In 1993, American production workers found that without continual training, they were unable to adequately meet the challenges of rapidly progressing technology, global competition, and corporate mergers. *Project Gold* was a three-year Federal Workplace Education Grant aimed at these production workers. Collaborative partnerships arose between a community college, a private non-profit organization, and a mid-size telecommunications equipment manufacturing plant in Central Florida. This project was only a small part of a nationwide collaborative effort to assist companies in addressing a lack of American global competitiveness.

This project was unique in that it had a dual focus: One part was a computer-assisted instructional learning center to update or enhance basic skills. In this center, PLATO and *I Speak English* software was used: PLATO for the basic skills, as well as for some specialized problem-solving skills such as Statistical Process Control (SPC) and *I Speak English* for the English as a second language students (ESL). Another example of training received in the learning center was GRE preparation. A residual benefit to *Project Gold* was that all of these students become quite skilled at working on computers. This was a plus that the company had not considered.

The procedure was the following:

1. Students would enter and receive the Test of Adult Basic Education (TABE) in order to assess their basic skill levels.
2. PLATO would draw up an individualized education plan (IEP) for each based on their specific needs.
3. They would then commence their self-paced training with regular progress reports being generated – which proved to be very motivational to the students, as well as to management.
4. On-the-job follow-ups were then carried out, as meetings were set up with management to discuss visible results.

The second focus of the project was on customized training geared specifically to meet industry needs. First, a certified job profiler conducted a job analysis though interviews, surveys, plant tours, and meetings with subject matter experts (SME's) and task analysis. A customized curriculum was created and methods and strategies selected, as well as securing the best media, materials, and instructor. Finally, creative scheduling was undertaken. Given that timing is everything in manufacturing, we worked closely with management in designing a training program that would not cause undue scheduling stress. Some examples of customized training offered in this project were Bright Ideas (creative problem solving), American Production and Inventory Control Society (APICS I & II), Statistical Process Control (SPC), teamwork, Regular Problem Solving, HAZCOM, and New Technology Training.

A second collaborative program was being conducted simultaneously with Project Gold. It was the *Electronic Technology Advanced Program (ETAP*) that involved a partnership with the manufacturing plant, the public school system, and a community college.

ETAP was a dual system combining theory with practice that originated in Germany a hundred years ago. It begins with basic skills and knowledge and progresses to a highly technical level. The *ETAP* program includes a "Pre apprenticeship" program for high school students that were tied to the "Tech Prep" initiative. The second was an apprenticeship program for community college students to obtain an Associates of Science Degree in Electronic Engineering Technology, an electronic industry certification, and Government Certification.

ETAP was designed to search find qualified, highly motivated high school students, and offer them a scholarship and hands-on applied training. Then upon graduation, accept them into the actual program where they would then be paid for two On-the-job-training periods and receive tuition and fee reimbursement for a two-year Associate Degree – all of this with the ultimate goal of employment within this company. The program would enable students/employees to compete using globally benchmarked world-class standards with recognized credentials, train in critical manufacturing technologies and customer service, and train an incumbent new work force, existing workforce, and instructors/mentors.

Virtual Universities

Today the world is rapidly turning toward electronic learning. Virtual universities are popping up everywhere: Florida, California, Kentucky, New Jersey, Israel, Germany, and Canada to name a few. The manufacturing plant where the two above-mentioned programs operated also has a virtual university. Employees can be motivated to learn if they understand that it will possibly increase job security. It was proven with *Project Gold* and the ETAP program successfully proved this concept in our high schools and community colleges. *ETAP* is now called *ACE-NET* involving the same partnership but now it leads to an AS degree in Computer Engineering Technology.

This educational history of this manufacturing company has led up to the E-learning that is now taking place. Workers can still attend the basic skill updating classes at the community college. However, today, this company has a *Virtual University* of its own. *Their goal during 2001 is to convert at least 60 % of all training programs to either Computer Assisted Instruction (CAI) or E Learning.* Next year, *the goal is for 75% and finally 100% in 2003*! Thus, as is readily apparent -- *Technology* marches on!

Conclusions

We have examined two organizations, one in the east, a second in the west. Both faced training issues that impacted line-employees where communication and work-related skill assessment and development were key to their future success. Management issues accompanied the decisions as to what training needs were and the basis upon which such decisions would be made. Despite being separated by oceans and miles, the problems encountered were identical while the proposed solutions differed only in their complexity. Both solutions were designed to achieve success on the part of all, with quality control being the common element. The progress made in the Florida scenario paid off with results that not only are being continued, albeit in another location, but amplified within the organization as well. The jury remains out in the instance of the Taiwanese manufacturing plant until sufficient time elapses to test the model as proposed.

As has often been concluded in the past, while cultures may differ, the basic issues related to e-learning, training as a whole, and employee demographics are often far more alike than different. This, we feel, is an accurate reflection of today's rapidly advancing techno-economy.

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Visual Testing: Searching for Guidelines

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Abstract

An experiment was conducted to investigate the influence of the variables 'realism' and 'context' on the performance of biology students on a visual test about the anatomy of a rat. The instruction was primarily visual with additional verbal information like Latin names and practical information about the learning task: dissecting a rat to gain insight in the anatomy of a mammal. Students were tested on: (a) recognition of anatomical objects, (b) labeling of these objects and (c) relations between objects. Results indicate that the amount of realism and context used in the text influences test performance depending on the learning tasks. Test results also show a learning hierarchy in the different learning tasks with the recognition task being the easiest and the relations task the most difficult.

Introduction and the Context of the Problem

In several courses that are taught in the faculty of Biology at the State University of Groningen in the Netherlands, it is considered necessary that students learn about the anatomy of a mammal by dissecting the body of a rat. The students perform this task in a two-day practical in which they dissect dead animal material (the rat) layer by layer to identify the different anatomical structures such as the different muscles and organs. This practical will always exist in this way as the faculty staff takes the firm position that the students need the experience of the stepwise dissection of a real rat to gain thorough understanding of these anatomical structures. Careful dissection of the animal enables the student to examine every part of the rat in detail and to get a grip on what they have to learn.

The problem occurred due to the teaching approach in which the students had to report about their observations by making anatomical drawings of the anatomical structures according to drawing rules that were part of the instructions of the course. The drawings of the anatomical structures had to depict all parts involved with their relative proportions and their interconnections, together with the Latin names of the parts in a legend in the margin of the drawing. After two days work, each student had produced a set of drawings of a rat. The problem was that a limited number of staff members had to correct the work of large numbers of students. There are about 150 students yearly, distributed over two courses for first-year biology students and second-year pharmacy students, who produced about ten drawings each. The correction of these drawings is so time consuming, that the students sometimes had to wait for months before they get feedback on their performance. This situation was educationally undesirably. Further the variety of drawing skills of the students introduced a subjective element in accepting or rejecting a drawing as a correct presentation of a given anatomical structure. Moreover, different members of the teaching team put different accents while rating student performance. Uniform evaluation of the drawings could therefore not be guaranteed. This situation was highly unsatisfactory. So the problem was that the variety of the students drawing skills leads to a subjective judgment. Besides this the spread of the correction work over several teachers caused a non-uniform evaluation and last the students received delayed feedback.

These limitations resulted in the need of the teaching staff to look for other possibilities for assessment. That need motivated this research project. The identified assessment problem is, however, more general than the problem with the drawings in the particular practical about the anatomy of the rat. The learning outcomes that have to be assessed are largely in the visual domain (the anatomical parts and their relative positions and interconnections), which led to the choice to study the assessment problem on a more general level in the field of visual testing. The concrete problem of the practical about the anatomy of the rat will then be used as the test bed for that study.

Visual learning - Visual testing

In searching for alternatives for the assessment on the basis of student drawings, the construct to be learned during the instruction had to be redefined. According to Cronbach and Meehl (1955) "a construct is some postulated attribute of people that is assumed to be reflected in test performance. In test validation the attribute about which we make statements in interpreting a test is a construct". In the case of the anatomy of the rat the construct to be learned consists of (a) the decisive visual characteristics of anatomical objects like shape, size, texture and color of the object, (b) the spatial relationships between the objects and the relative size of each object in relation to other objects, (c) the verbal labels and descriptions of the objects, and (d) the functional relationships of objects. This construct is essentially visual, whereby the verbal labels and descriptions extend the qualities of the construct into the verbal domain, allowing for verbal communication about the spatial structure and its components

The definition of the learning construct resulted in the definition of learning tasks for the instruction. After following the course, the students should be able to (a) recognize the different anatomical structures, (b) label each structure by its Latin name, (c) specify their spatial orientation and (d) specify their functional interconnections. The learning outcomes can subsequently be assessed by requiring the students to demonstrate that they are able to fulfill three tasks: (a) the recognition task, (b) the labeling task, and (c) the relations task. In the recognition task the students must recognize the correct object according to its visual characteristics. In the labeling tasks the students has to identify an object by its Latin name. The relations task is a task in which the student has to show understanding of the spatial relations between objects by their functionality.

Although the instruction is primarily visual, it is relevant to know whether the assessment should also be visual. According to the stimulus generalization theory (Hartman, 1961) learning increases as the testing mode approximates the mode in which the information was presented. Dwyer (1978) gave an example in which he stated that instruction presented via a visual modality but evaluated in a conventional pencil-and-paper assessment would probably not provide an accurate representation of the total amount of learning that has occurred. The effectiveness of instruction presented to the students through a visual channel might most appropriately be measured by employing criterion measures assessing contributions of the visual mode of instruction.

As in all learning also in visual learning the more complex contructs contain concepts and relationships that are hierarchically ordered. Smith and Ragan (1999) summarized theories about learning hierarchies which all prescribe a similar pattern: learners first should be able to recognize a concept in order to identify that concept by its name. The acquired concepts then form prerequisites for more difficult tasks such as problem solving. Dwyer (1978) made a distinction in phases in a learning hierarchy for visual learning, starting with facts and definitions in a content area that are familiar to a person. In this way the person is prepared to relate and combine known and new elements to form new concepts. The more concepts a person possesses, the easier it is to form generalizations and rules. These processes are again prerequisites for problem solving. Dwyer (1978) states that: "the implication to be derived from the concept of a learning hierarchy is that since there are different kinds of educational objectives there also are different kinds of learning, each requiring students to perform different kinds of activities and each possessing unique conditions for optimum learning to occur". This assumes that in designing a visual test, it is required to look more closely to the type of item format that will assess these different kinds of learning in a valid way. In this case, the recognition task of the visual concepts is a prerequisite for identifying that concept with the correct name. Together they are prerequisites for the relations task.

Item types

For visual testing, Dwyer (1978) designed the PSE-test (PSE: Program of Standardized Evaluation) in which he tested the learning effect of instruction given verbally with additional visualization versus verbally alone. The subject of instruction is the anatomy of the heart. The test consisted of four parts: (a) a terminology test, (b) an identification test, (c) a drawing test and (d) a comprehension test. The terminology test measures the students knowledge of specific facts, terms and definitions. The identification test measures the students ability to identify parts or positions of an object. The drawing test measures the students ability to construct and/ or reproduce items in their appropriate context and the comprehension test measures the students understanding of the heart, its parts and its internal functioning. These four tests combined form an overall test for measuring the student's total understanding of all the content material. The identification test, terminology test and comprehension test consisted of multiple choice items only. The test items for the comprehension test was the most difficult since they were designed to measure the student's understanding of complex procedures and processes.

The use of multiple choice items is sometimes being criticized. Martinez (1999), for instance, who is also active in the field of visual testing, claims that multiple choice items often elicit low-level cognitive processing. He designed constructive figural response items (CFR) which would evoke complex thinking and therefore be more appropriate for testing the student's understanding of complex procedures and processes (Martinez, 1994). These items differ from traditional items in two ways: (a) they require mental construction of a response, rather then selection among options, and (b) they require demonstration of proficiency in a figural medium. Martinez (1990) argued that comparison of multiple choice items with their figural constructive response counterparts showed that CFR items were more difficult, more discriminating and more reliable. Martinez (1999) argues that the use of CFR items is best for items that evoke complex thinking. Other research outcomes (Martinez & Jenkins, 1993) were that CFR items were better able to distinguish between novices and experts. CFR items are sometimes referred to as free response or open-ended items.

Martinez (1993) and Parshall, Davey and Pashley (2000) recognized the fact that as technology improves it becomes more useful in visual testing because it gives possibilities to innovate item formats for visual testing by using objects and media in item formats. This may bring an interactive aspect in the item, for instance by requiring students who take the test to scale object size by dragging with the mouse or to move objects to required positions.

Variables for the study

The visual aspects of the construct to be learned are decisive visual characteristics like shape, size, texture and color of the objects. The representation of these characteristics in visuals is affected by the amount of realism of those visuals. 'Realism' is mostly associated with photographic pictures. More schematic representations such as line drawings are regarded to be less realistic, although they may be more effective to articulate certain visual characteristics than realistic pictures do. Dwyer (1978) claims that the effectiveness of realism in this sense depends on the learning tasks and the instructional method. According to Mandler and Ritchey (1977, in: Anderson, 1994), however, people are better in remembering the meaning of a visual then the details of that particular visual. Which would here mean that realism would not add to visual testing because the details are not important since people only remember the meaning. This uncertainty was reason to choose 'realism' as the first variable for this study.

The construct to be learned also contains the recognition of objects with their spatial positions between other objects and the relative size of the objects in relation to each other. The availability of the other objects appears to influence the recognition of objects. Cave and Kosslyn (1993) conducted an experiment in which they speak of 'holistic pictures' when objects are embedded in a visual context. They found that the recognition of objects in holistic pictures resulted in higher mean scores then the scores for isolated objects. Research in the field of face recognition (Tanaka & Farah, 1993) resulted in a similar outcome. Tanaka and Farah demonstrated that recognition of facial components was facilitated by the presence of the facial contour. Isolated facial objects were difficult, in most cases impossible, to recognize correctly.

The results of Mandler and Ritchey as well as those of Tanaka and Farah suggest that 'visual context' is a relevant variable for visual testing. 'Context' was thus selected as the second variable for this study.

Hypotheses

The effect of the variables 'Realism' and 'Context is studied on the basis of three hypotheses. The contradictory results of earlier research about the amount of realism led tot the first hypothesis:

H1: There will be no difference in mean score between items with realistic color pictures and items with schematic drawings.

Hypotheses of this kind have mostly been studied with types of instruction that are primarily verbal with additional visuals. In our case, the instruction is primarily visual.

The variable 'Context' is studied by testing the second hypothesis:

H2: Items with contextual information will result in higher mean scores then items without contextual information.

Hypothesis three is based on the theory of learning hierarchy. The requirement that concepts of anatomical structures have to be learned as a prerequisites for understanding functional relations, lead to the assumption that this letter task is more difficult:

H3: Items testing the relations task will be more difficult then items testing recognition and labeling.

Item formats

Item formats were chosen based on the insights of Martinez (1999) and Martinez and Jenkins (1993) that recognition could be assessed with multiple choice items whereas items requiring more complex tasks such as relating objects based on functional relationships should be tested with CFR items. For the purpose of the study eventually the following item formats were used:

1. Multiple choice items
2. Labeling items
3. Connect-the-dots items

The multiple choice items all contained four alternatives in which the correct object had to be recognized. In the labeling items the examinee had to identify an object by its Latin name which could be chosen from a long list in an index. The connect-the-dots items are examples of CFR items. With the connect-the-dots items, examinees had to make connections between anatomical objects and also give the direction of these connections according to their functionality.

Experimental Design

Figure 1 gives an overview of the 2*2-experimental design in which there were two independent variables being the amount of realism and the context information. For the variable 'Realism' the choice was made to look at the influence of colorful realistic pictures (photo's) of anatomical structures versus the influence of schematic drawings of the same structures. The variable 'Context' was operationalized by looking at the influence of the presence of contextual information versus the absence of context. Figure 1 summarizes the experimental design.

		Realism	
		Picture	Drawing
Context	Yes	Picture + context	Drawing + context
	No	Picture - context	Drawing - context

Figure 1. Independent variables and conditions

De dependent variables are test scores for each of the three learning tasks of the course and a total test score for all test items together:

1. The mean test score on recognition items
2. The mean test score on labeling items
3. The mean test score on relation items
4. The mean test score on the overall test

Method and Procedure

The sample population consisted of 134 first year biology students. The students followed the dissection course for two full days. During these two days the rat was dissected in ten layers. The students were working in groups of thirteen and every student got an own rat for dissection. Before the course each student received a study guide with the instructional objectives and the dissection steps explained according to a cued instruction. The cues that were used in the guide were all Latin names of the anatomical objects that they had to learn. The cued instruction for each dissection layer followed a certain procedure in which the students as a group got a live demonstration of the dissection of that particular layer by a teaching-assistant. The teaching assistant used the Latin names to identify the different anatomical objects, show the important visual characteristics and explain the different functions of each object in accordance to their interconnections. After the demonstration, the students were required to dissect the current layer individually and accordingly observe the anatomical objects. Students had the freedom to take notes during the observation by making drawings of their observations. After completion of the individual dissection tasks, the students were asked to join the group and have a group discussion about the observation with the help of a poster that contained the outline drawing of the dissected layer. Every student had to label at least one anatomical object with its Latin name. At the end of the course on the second day, the student performed a computerized test. The test contained 57 items of which 19 items were based on recognition tasks, 20 items were based on labeling tasks and 18 items were based on relations tasks. The test was specifically developed for the purposes of the experiment. Three groups of questions were designed to measure achievement on the three different learning tasks: (a) multiple choice items, (b) labeling items, and (c) connect-the-dots items. For the picture-version (the realistic version of the variable 'Realism') photographs were taken of all needed visual materials. Image-processing software was used to produce the correct alternative and also the distracters for the multiple choice items, for isolating objects for the no-context-condition, and to add a graphical layer with dots to be connected for the connect-the-dots items. For the drawing-version of the test students of an art school were recruited to make the drawings. The testing program itself was programmed in C++.

Students were randomly assigned to one of the four conditions being: (a) picture with context, (b) picture without context, (c) schematic drawing with context and, (d) schematic drawings without context. At the start of the test, each candidate got an example of each item format to get acquainted with the style of questioning. The results of the test were analyzed quantitatively in SPSS 10.0 by comparison of means, ANOVA, Univariate Analysis of Variance and reliability tests.

Results

Table 1 gives an overview of the results of the univariate analysis of variance on the variables ‘realism’ and ‘context’. The table gives an general overview of the significant differences for every learning task and the overall test.

Table 1. Univariate Analysis of Variance on variables ‘realism’ and ‘context’

	Recognition		Labeling		Relations		Overall test	
	F	Significance	F	Significance	F	Significance	F	Significance
Realism	11.266	.001	2.076	.152	6.727	.011	7.877	.006
Context	38.129	.000	.485	.487	1.762	.187	.811	.370
Realism * Context	36.218	.000	.170	.680	.049	.049	.128	.721

The results are discussed below by realism, context and item difficulty.

Realism

Figure 2 shows the mean scores of the examinees for the condition realism of drawing versus colorful pictures on the different learning tasks and on the overall test. These mean scores are on a scale of 0 to 10.

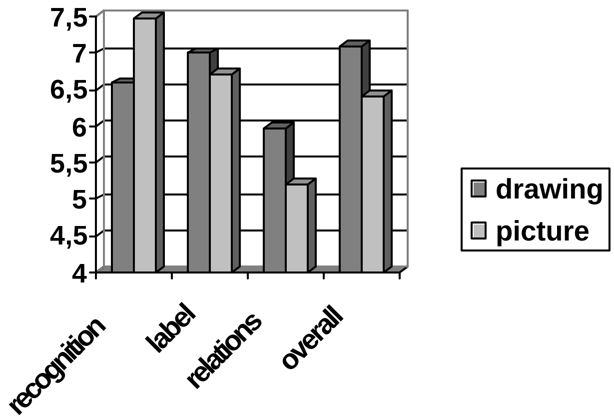

Figure 2. Results of the mean scores on the condition realism: picture vs. drawing,

As can be concluded from Figure 2 and Table 1, there were differences between drawing (for which the exact mean is M= 6.59) and picture (M= 7.48) on the recognition task in favor of picture with a significant difference (p = 0.001). For the labeling task there is a slight difference between the conditions in favor of drawing but this difference is not significant (p = .152). However, the difference found on the relations task between drawing (M= 5.98) and picture (M= 5.19) was significant (p = .011) in favor of drawing and for the overall test the difference between drawing (M= 7.10) and picture (M= 6.42) was also significant (p= .006) and in favor of drawing.

Context

Figure 3 gives an overview of the mean scores for the presence of context versus the absence of context on the different learning tasks and on the overall test. The scale of the mean scores is from 0 to 10.

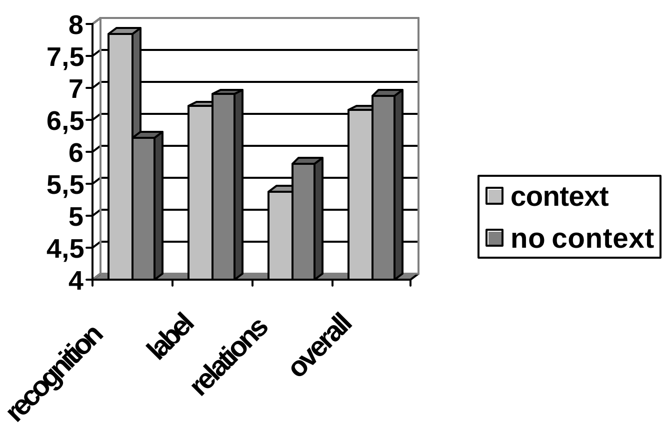

Figure 3. Results of mean scores on the condition context: with context vs. without context

As can be concluded from Figure 3 and Table 1, there were differences between the presence of contextual information in the test where examinees score higher for the recognition of objects (M= 7.84) then in the absence of contextual information (M= 6.21). This is the only significant difference (p = 0.00) that was found. The slight differences that were found for the remaining tasks were not significant which resulted in the overall test also showing no significant differences.

Realism * Context

An interaction effect was found between realism and context for picture (M= 7.48) and the existence of context (M= 7.84) with a level of significant of p= 0.00.

Item difficulty

Table 2 gives an over view on test reliability for Cronbach's alpha and the standard error of mean.

Table 2. Test reliability with Cronbach's alpha and Standard Error of Mean

	Ss	N (items)	Cronbach's alpha	Standard Error of Mean
Overall test	134	57	.8583	.066
Recognition items	134	19	.5873	.097
Labeling items	134	20	.7788	.061
Relations items	134	18	.7113	.097

Table 2 shows that the overall test is reliable with Cronbach's alpha being .8583 and an SEM of .066. The least reliable are the recognition items. Labeling and relations items are equally reliable. Figure 4 shows the item difficulty for the three learning tasks. The scale on the horizontal axis is from 0 to 10 and gives an overview of the proportions of students that answered a particular item correctly on the different learning tasks.

Figure 4 shows a difference in item difficulty with recognition tasks being the easiest and relations tasks the most difficult. Table 2 and Figure 4 complement each other. Figure 4 shows that low reliability of recognition items may be caused by a ceiling effect. The recognition items are obviously rather easy. The more difficult tasks are discriminating much better between learners who know and those who have learned less. The distribution of the items on the scale for the relations tasks shows that this task was the most difficult and the most discriminating. As this task was (thus) also very reliable, the results support the contention of Martinez (1990) who argues that these characteristics are typical for figural-constructive-response items. CFR items seem a proper choice for distinguishing between experts and novices.

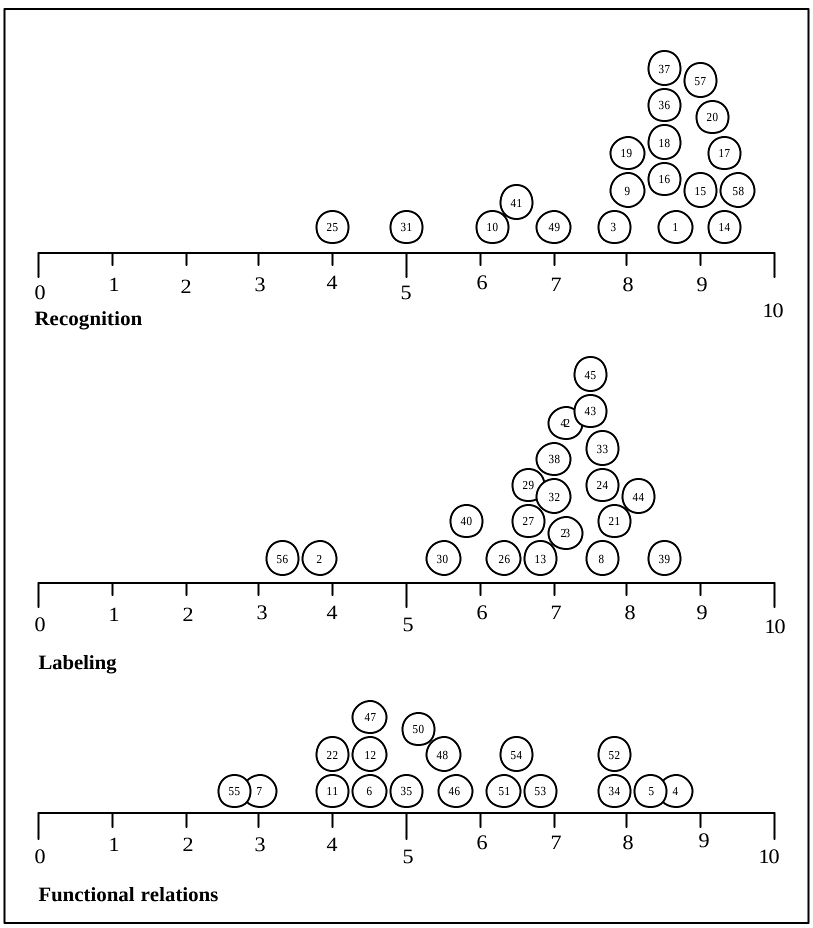

Figure 4: Item difficulty for each learning task

Discussion and Conclusions

Returning to the hypotheses stated earlier in the paper and the experimental results, some conclusions can be drawn on visual aspects of visual testing.

Hypothesis one

The first hypothesis states that we may expect no differences in mean scores between items with realistic color pictures and items with schematic drawings. This hypothesis must be rejected. We did find a significant difference in favor of picture over drawings for the recognition task. Also, a significant difference was found in favor of drawing over picture for the relation task and the overall test. These results suggest possible guidelines which are that for constructs that are primarily visual, it is best to test recognition of objects with pictures and to test relations between objects with drawings. The richer amount of stimuli in pictures thus seems to help recognition of necessary visual characteristics, while for the more abstract relations task, the main characteristics of the objects are sufficient. Drawings can be focused on these main characteristics. These findings comply with the results of Mandler and Ritchy (1977) who found that people are more sensitive to remember the meaning of a visual then the details.

Hypothesis two

The second hypothesis expects that items on contextual information will result in higher mean scores then items without contextual information. This expectation was only true for the recognition of objects. Thus it seems that for recognition tasks the examinees are helped by 'holistic visuals' in the sense of Cave and Kosslyn (1993) to succeed in answering the test items. For the other tasks the isolated objects gave sufficient information to complete the task.

Hypothesis three

The third hypothesis states that the relations tasks will be more difficult then the recognition and labeling tasks. This hypothesis cannot be rejected. The relation tasks appears to be the most difficult one. This finding supports the findings of Dwyer (1978) stating that recognition and labeling are prerequisites for relations. There is also the possibility of Martinez and Jenkins (1993) stating that CFR items are better able to distinguish between novices and experts then multiple choice items which is supported in our results in which the items on the relations task were the most difficult but had a wide spread in scores in contradiction to the items of the recognition and labeling tasks.

The main conclusions of the experiment are that:

1. Anatomical structures were better recognized as picture than as drawings.
2. Drawings yielded better results for test items on relations between anatomical structures than pictures.
3. The results for the overall test favor the use of drawings over pictures.
4. Context helped to recognize anatomical structures.
5. Scaling of item difficulty from easy to difficult shows the following order: Recognition - Labeling - Relations.

As far as guidelines for constructing visual tests are at stake, the results for 'Realism' and 'Context" gave reason for two guidelines:

1. The use of contextual information and color pictures can facilitate the recognition of objects.
2. In order to assess the knowledge of relations between objects based on spatial relationships or object functions, the use of schematic drawings can be sufficient.

In regard to item types, a guideline about CFR items seems to be justified:

1. For visual tests to distinguish between experts and novices constructive figural response items can be useful.

These guidelines need further study to get a more precise insight in the relationships between learning tasks and visual aspects. New technological possibilities for innovative item types, may extend definitions of visual constructs in ways yet to be found. The field of CFR items is thereby interesting as new assessment methods to measure particular constructs are there already technically available. Methods for scoring these items are a challenge and need further research for the development of suitable scoring algorithms. The current study was just a modest step to set the stage for further research on visual tests.

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Student-Governed Electronic Portfolios as a Tool to Involve University Teachers in Competency-Oriented Curriculum Development

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Abstract

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

The Project

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

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

The use of portfolios offers a possibility to build evidence of the development of competencies. The main attraction of portfolios is formed by its potential to assess progress and process as essentials for learning (Saywer, 1994). In the new curriculum portfolios are introduced for self-assessment by the students as well as for monitoring their progress.
Starting in the academic year 1999, electronic portfolios were introduced to provide students with a tool for actively working on competency development. The introduction was monitored and the use of the portfolios was developed in a few steps aiming at answering the following question:

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

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

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

The educational concept "initiation in the academic profession"

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

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

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

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

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

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

The first experiences

Preparing for the academic year 1999-2000

The principles of the new approach have been presented to the teaching staff on several occasions, at first to estimate whether the concept was appealing to them. The overall impression was sufficiently positive to start the preparation of the introduction of the new approach in the program. A few months before the academic year 1999-2000, a group of student-friendly staff members was invited as mentors. Together with the faculty management they developed procedures and a related manual to start the new mentor groups. Involving the mentors at this stage resulted in their ownership of the concept for the new mentor groups and the way of working in those groups. Elements of the approach are that competency development was related to three major roles of professionals in our field: designer, researcher, and consultant; and that explicit attention should be paid to generic competencies such as planning, self management, interpersonal skills, communication, and academic reflection. In respect to the individual development of the students, a list of products that should be collected in the portfolios was specified. They concern results from assignments in courses that may be considered as evidence of acquired knowledge and skills, thus contributing to the competency profile of the student. Monthly professional meetings of the mentor groups were planned to discuss progress. During these meetings also attention was paid to the quality of the program as experienced by the students. It was expected that the students in their role as beginning educational designer should be interested in strengths and weaknesses of the courses in which they participate. The input from the mentor groups was also considered as valuable for the formal evaluation of running courses. The teaching staff was informed about the intended approach and invited to work accordingly.

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

Results from the academic year 1999-2000

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

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

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

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

2000-2001: Some changes

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

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

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

Results from the academic year 2000-2001

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

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

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

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

Putting students in control

2001-2002: A last chance for portfolio's?

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

The results so far

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

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

Discussion

Why portfolio's can be a success

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

Why portfolio's fail

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

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

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

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

Where to go from here?

Who wants to succeed in an effective learning process, ought to be able to coordinate his own learning process (McCombs, 1988). In order to make the concept "initiation in the academic profession" successful, we will have to arrange a situation in which the students will be helped to get ready to do so. And this has primarily to happen in courses, while the new mentor groups may have a support function. The developmental readiness of the students has to be taken into account. Alexander (1995), for example, mentions three stages for the evolution for the learner. In the habituated stage, the student has a diminutive knowledge level. Having just a little domain-specific knowledge the student appeals on common strategies. The second stage is the ability or competency level. The students get more comprehensive and coherent knowledge of the subject and there is a change the student will select the correct strategy for the specific situation. The third stage is the expert level. At this stage the students have ample knowledge of domain specifics, are ready to regulate themselves, and are able to add new knowledge to the domain. These stages ask for a curriculum line in which each stage has a logical place. This leads in our case to a choice for courses in which the three stages have a natural place: the series of courses about design methodology that runs form the first to the third year. This choice is inspired by the Design Studio as it works at the Master's level at the University of Georgia at Athens (Rieber, 2001). The principle as it will be tried in our program is that third-year students will take responsibility for design assignments while second-year students will act as helpers for specific tasks that need already proper workmanship (like carrying out a literature study or an evaluation), and first year students will be used for very concrete tasks for which it is not necessary to be very knowledgeable about the specific domain. In this stream, the principles of the concept "initiation in the academic profession" may be fully exploited, together with the use of portfolios. Next to and in balance with this stream, theory courses may still be taught in more traditional ways as long as all teaching complies with the seven principles for good practice in undergraduate education as listed by Chickering en Gamson (1987, quoted by Chickering en Ehermann, http://www.aahe.org/technology/ehrmann.htm): (a) good practice encourages contacts between students and faculty, (b) good practice develops reciprocity and cooperation among students, (c) good practice uses active learning techniques, (d) good practice gives prompt feedback, (e) good practice emphasizes time on task, (f) good practice communicates high expectations, and (g) good practice respects diverse talents and ways of learning.

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

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Video Outside Versus Video Inside the Web: Do Media Setting and Image Size Have an Impact On the Emotion-Evoking Potential of Video?

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Abstract

To explore the educational potential of video-evoked affective responses in a Web-based environment, the question was raised whether video in a Web-based environment is experienced differently from video in a traditional context. An experiment was conducted that studied the affect-evoking power of video segments in a window on a computer screen compared to presenting the same video materials on a television monitor. The study first demonstrates that affect-evoking power of video exists. Although not always significant, the results show that selected positive and negative video clips induce positive or negative affective responses and mood changes in participants, in a Web-environment as well as in a television environment. Smaller window sizes, however, may do less well.

Introduction

Technical developments make it continually easier to use streaming as well as downloadable video in Web-based applications. This raises growing interest in the use of video segments within Web-based multimedia learning environments (see for example Collis & Peters, 2000). Video has the potential to present dynamic content. In the cognitive domain moving images with sound and accompanying voice-overs may, for instance, provide insight in technical processes and procedures. In the affective domain video materials may evoke affective responses in the learner that relate to the instructional content of interest. A well-known example is the use of trigger video's that present emotional demanding situations as input for learning experiences. These examples represent two characteristic functions of video: (a) the potential to facilitate the acquisition of knowledge and skills, and (b) the use of video to bring material into the learning environment for affective learning goals. The present study relates to this second function of video.

Affective video materials can show realistic situations and people depicted directly from reality or dramatised in story lines. Footage from real situations as well as dramatised story lines make it possible for viewers to identify themselves with persons on the screen and to become involved in the situations that those persons meet. For educational purposes this potential of video is used to evoke emotions and to stimulate discussion. Topics to be discussed may vary from historical and societal to ethical issues. Not only the content of the video is important for evoking affective responses, but there is also a contribution from production variables such as music, editing, camera handling and lighting (resulting in a "video structure"). Video content and video structure are not independent but interacting variables. Video-production techniques and their influence on the way video content is experienced are discussed in for example Wetzel, Ratke and Stern (1994) who approach video design from a research perspective, and Millerson (1999) and Zettl (1999) who draw upon the trade of film and video makers. The potential of video to evoke emotions and the relationship between video structure and video content is also a topic in communication research (for example: Geiger and Reeves, 1991; Lang, Dhillon, & Dong, 1995; Lang, NewHagen & Reeves, 1996).

Affective video materials may further have educational potential when combined with specific (creative) tasks that follow a segment. Research studies by Isen (for example Isen, Daubman, & Nowicki, 1987) and Kaufmann and Vosburg (for example Kaufmann and Vosburg, 1997, Study 2) show that video segments used to evoke emotions can influence the performance on a task that follows the video segment. The content of the video segments that they used was not related to the task, but served merely to induce an affective response or mood in the subjects. Their work shows, however, that video may be considered as an effective emotion-evoking or "mood-induction-technique", a finding which is confirmed in a review by Gerrards-Hesse, Spies, and Hesse (1994).

The tasks involved in the research of Isen and Kaufmann and Vosburg are (creative) problem-solving tasks, varying from categorization, association, developing insight, to divergent thinking tasks. Positive and negative mood states seem to be related to the way a problem-solving task is carried out. Their results suggests that a positive-affect video could be more effective for a certain type of task and a negative-affect video for another type of task. For a recent model about the influence of mood on problem solving, see for example Vosburg and Kaufmann (1999).

Affective video materials implemented in a Web-based learning environment are expected to be potentially similarly effective for reaching specific pre-defined affective goals and for having a mood-inducing function that stimulates the solving of specific problems. As an additional effect affective video might also contribute a sense of “warmth” to a technological system like a Web-based environment which may help to maintain interest in the learning task.

This study is a step in exploring these expectations by first trying to confirm that video has indeed the potential of evoking affective responses and mood changes in subjects in a traditional setting for watching television. Subsequently we will examine whether video materials presented in a Web-like environment have a similar effect.

Video materials in a Web-based learning environment are presented in a video window that is smaller than video shown on a television screen. Therefore a second question is raised whether image size is a relevant design factor that influences the affective potential of video materials in a Web-environment. Research on image size of emotion-evoking movie fragments shows that screen size does indeed have an effect on how the movie is experienced. Little screens are less liked, produce less arousal and the content is remembered less compared to big screens (Reeves & Nass, 1996; Reeves, Lang, Kim & Tatar, 1999). Video materials presented in a little video window within a Web-environment may thus have less affective potential than the same videos presented in a bigger video window.

From an instructors point of view, who may be considering a shift from traditional classroom-use of video to using video within a Web-environment, it may be relevant to know whether differences exist between the two types of media settings (watching television vs. watching video in a window on a computer screen). This will be the third question of our research.

In summary, the following three research questions are stated to explore the affective potential of video materials in a Web-based environment:

1. Are video materials that are selected for their potential to evoke either positive or negative affective responses and mood changes in participants, effective when the video is presented:
   a)within a traditional television-viewing setting (group or individual setting), or
   b)within a Web-like environment (individual setting).

If this is the case:

2. Does image size have an effect on the magnitude of affective responses and mood changes in participants (within Web setting; within television setting).
3. Does the media setting have an effect on the magnitude of affective responses and mood changes in participants (between television and Web)?

Method

To study these questions, an experiment was carried out that is specified below.

Participants

The participants for the experiment were 117 first-year university students in communication studies (82 women and 35 men, mean age = 18.5 years). The experiment was part of a course that introduces the field of media communication and media research and was introduced as an introduction to doing experiments. The results of the experiment and the experience of the students in participating in the experiment were discussed in class a month after the experiment.

Materials

For the selection of affect-evoking video materials, video segments of about two or three minutes were used from existing films or television programs. In a pilot study situated in a traditional classroom setting, six video clips were tested with students for the affective responses they evoked. Some of the clips showed positive content (content that is expected to evoke positive feelings), other clips showed negative content. The pilot showed that two of the positive video clips and two of the negative video clips were effective. For both affect types the briefest clips where selected for the experiment. Selecting the short clips seems justified by the fact that Web users are used to brief presentations. The shorter clips are thus more realistic to embed in a Web-environment than longer clips (5 minutes or longer). In the experimental setting the positive video content consisted of a segment from the comedy movie 'When Harry met Sally' (2'45"); the negative video content was a news-item about 'Hunger in Ethiopia' (2'04"). Half of the subjects were shown first the negative content and then the positive content. For the other half this was the other way around. To 'buffer' the impact from one type of affective content to the other a video segment was presented in-between (a segment from an instruction video on welding, 2'27"). To establish a comparable starting position for all subjects a video segment was added as a first video clip for all participants. This segment was a part of a documentary about birds ('1'53").

Design and procedure

An experimental factorial pretest-posttest design with three factors was chosen. Factor one is the 'affective content of the video' (positive versus negative). Factor two represents the 'playback size of the video' (little versus big; the bigger size is linear two times the smaller size, resulting in an image area that is four times the smaller size). Factor three is 'media type' (television monitor versus computer monitor). All three factors were studied with settings for individual participants. In addition to the individual settings a group setting was introduced as an extra factor to explore social effects that may influence the magnitude of affective responses to video.

Subjects were randomly assigned to one media type setting and within this setting to one video playback size. A matching procedure was used for the variable male/female. Subjects received in advance information about the location of the experiment and the allocated time for it. At the entrance of the experimental room the subjects were given a number to a specific 'seat' in the room. For each seat the presentation order of the positive and negative video segment was predetermined. The two versions were:

Version 1: clip2=positive and clip4=negative, and
Version 2: clip2=negative and clip 4 = positive.

All subjects encountered both positive and negative video contents. Table 1 shows the order of clips in all settings.

Table 1. Overview of the experimental conditions

	INDIVIDUAL TELEVISION SETTING	INDIVIDUAL COMPUTER SETTING
Small	Small television monitor (14”, S-VHS-PAL) docu – pos – instr – neg docu – neg – instr – pos	Small video window (320*240 pixels, screen resolution: 1024*768) docu – pos – instr – neg docu – neg – instr – pos
Big	Big television monitor (28”, S-VHS-PAL) docu – pos – instr – neg docu – neg – instr – pos	Large video window (640*480 pixels, screen resolution: 1024*768) docu – pos – instr – neg docu – neg – instr – pos
	SOCIAL TELEVISION SETTING	
Big	Big television monitor (28”, S-VHS-PAL) docu – pos – instr – neg docu – neg – instr – pos	

Note:
docu = segment from a documentary about birds
instr = segment from an instruction video about welding
pos = segment from ‘When Harry met Sally’
neg = segment from a news-item about ‘Hunger in Ethiopia’

The experiment was conducted in four rooms:

- Room 1: Big television-monitor setting;
- Room 2: Little television-monitor setting.
- Room 3: Computer setting (for all computer conditions for small and large video windows);
- Room 4: Big television monitor in a social setting.

The individual arrangements were in such a way that the viewing angles for the television and the computer conditions were the same: Watching the big television monitor took place with the same viewing angle as watching the large video window on the computer screen; watching the small television monitor took place with the same viewing angle as watching the small video window on the computer screen. To accomplish this, viewing distances were carefully controlled.

Four experiment monitors and four assistants were hired and instructed. In advance students of the course were informed about the research group (time, and location) to which they were assigned. They were asked to gather in a central location in the building, so that no current sessions would be disturbed. Each experiment monitor for a certain condition (room) invited his/her group to go to the room. The assistants waited for the participants at the room. Upon entering the room, the assistants gave each participant their seat number (see above). They were asked to read the information about the experiment, fill in their name and wait silently for the experiment monitors to start the experiment. They also had to sign an attendance list for the course administration. A few days before and at the day of the experiment some students attended that were not in the register that was used for the assignment procedure. Because of the course credits they were allowed to participate and assigned to the different settings.

The experiment monitors gave a brief introduction to the experiment. The procedure and the instruments (questionnaires) where automated into a (web-like) computer-based environment. For the computer setting this was done to create the look and feel of a Web-environment. To be consistent in the overall procedure the individual television-monitor settings also used this environment for filling in the digital questionnaires. Thus in both settings the same procedures were used. In the social television-monitor setting printouts of the instructions and questionnaires were used.

In the computer setting the video clips were announced and shown within this setting. The video clips were shown as part of a separate almost full-screen window to provide a neutral (dark grey) background and was followed by a questionnaire. In the television-monitor setting the participants used the computer for filling in questionnaires and switched to watching a television monitor when a video clip had to be started. In this condition the video clips were available on tape in a video player. The videotape contained all four video clips. Each video clip was preceded by 10 seconds of black screen and the clip’s title (like

"Video clip 1") to assure enough time for the VCR to start playing and as confirmation for the participants that the correct clip was started. After each clip a message to stop the tape was presented.

Scoring

Instruments. A questionnaire containing bipolar affect and mood items using a 7-point Likert scale for response was used to assess the affect-evoking and mood change potential of the positive and negative video materials. Non-relevant items about cognitive responses (evaluations of the videos) and arousal items were included to make the aim of the experiment less obvious to the participants. A questionnaire consisted of three sections: A section with questions about the mood state of the participants (including also arousal items), a section about the feelings evoked by the video clip (affective responses) and a section with questions about the opinions (evaluations) about the video clip. As mentioned in the design and procedure section the instruments (questionnaires) where automated into a (web-like) computer based environment and presented after viewing a video clip. To prevent that participants would develop a repetitious way of filling out the questionnaires, the order of the sections in each questionnaire was varied and also the direction of the items. Since the second and the fourth video clip were the actual affective video clips of interest in the experiment, the section of the questionnaire that measured the mood state was always placed in such a way that a pretest – posttest measurement of these clips could be made. The last section of the questionnaire belonging to the first video clip was the mood section, because this was meant to be the pre-test measure for the second clip. The first section after viewing the second clip was again the mood section as a post-test measure. For the fourth clip the same strategy was used.

The final Mood scale consisted of three items, the final Affect scale consisted of five items (Figure 1).

Mood scale: three items:			Affect scale: five items:		
Very negative (1)	-	Very positive (7)	Very negative (1)	-	Very positive (7)
Very unpleasant (1)	-	Very pleasant (7)	Very unpleasant (1)	-	Very pleasant (7)
Very somber (1)	-	Very cheerful (7)	Very somber (1)	-	Very cheerful (7)
			Very sad (1)	-	Not at all sad (7)
			Very happy (1)	-	Not at all happy (7)

Figure 1. Rating scales for mood and feeling

A reliability analysis of the mood items showed that the three items together produced a mood scale with an average Cronbach's alpha score of .88. Originally there were six feeling items. They produced a reliability score of .85. When one of the feeling items (very involved / not at all involved) was deleted, the alpha score increased and resulted in an average score of .90. (See Table 2). The reliability scores for the Mood scale and the Affect scale are thus quite acceptable.

Table 2. Cronbach's alpha scores for the final mood and feeling scale

	Mood Scale (3 items)	Affect Scale (5 items)
Questionnaire 1 (clip1)	.7758	.8487
Questionnaire 2 (clip2)	.9358	.9811
Questionnaire 3 (clip3)	.8452	.8007
Questionnaire 4 (clip4)	.9557	.9842
Mean questionnaires	.8781	.9037

Results

Homogeneous treatment groups

The first video clip and accompanying questionnaire served as a pre-test measure for all treatment groups. An analysis of variance (one way anova) showed no significant differences between the groups on the Mood scale and the Affect scale (Mood scale $F[9,116]=1.048$, $p=.407$ and Affect scale $F[9,116]=.606$, $p=.790$). The treatment groups can be considered homogeneous on the dependent variables.

Group sizes and gender. The average group size was n=12 (11.7). On the average 29.9% of the participants were male and 71.1% were female. Data showed, however, that two treatment groups were different from the other groups. The treatment group "computer / small video / version 2 (clip2=neg, clip4=pos)" appeared to have a relatively small number of participants (n=6). For the treatment group "television / small video / version 2 (clip2=neg, clip4=pos; n=9)" atypical male/female proportions were observed of 66.7% en 33.3% respectively.

Affective responses and Mood changes

Within television settings. First we wanted to confirm whether positive and negative video materials could evoke affective responses and mood changes in participants within a traditional television viewing setting (both social and individual). A paired-T-test was conducted for the settings with television. In this analysis the first clip (documentary) was compared with the second clip (being positive in version 1 and negative in version 2).

For the positive clip significant effects were found in all television settings for a change in evoked affective responses. Only in the individual small television setting no significant mood changes for the positive clip were found (p=.358).

The negative video clip produced in all television settings significant effects for a change in mood state and in evoked affective responses.

Within Web settings. For the positive clip significant effects for mood change and feeling change were found in the Web setting with the large video in both versions. For the small video's no significant effects were found on mood changes (p=.119) and changes in affective responses (p=.078). The negative video clip produced in all television settings significant effects for a change in mood state and in evoked affective responses.

Comparisons of image-size within a media-setting

Procedure. As the data showed that two treatments groups of version 2 appeared to have a relatively small number of participants or an atypical male/female proportion, the analyses of the results will be based on version 1. In that version the sequence of the clips was clip 2 = positive and clip 4 is negative. For the exploration of image-size effects version 1 is taken as starting point for within-media-type comparisons. Clip 1 (documentary) had a slightly positive score for mood and affect and Clip 3 (instruction) had a slightly negative score on mood and affect. Both are, however, sufficiently close to the middle of the scale to be regarded as “neutral clips”.

Both for the Mood scale and the Affect scale only change scores are presented (not the absolute scores). Change scores are more informative because they represent the pretest-posttest differences in the line of the intentions of the experiment.

Within TV-setting: Big versus little TV. For the big tv-monitor setting (n=11) and the little tv-setting (n=15) the mean change scores for mood state and affective responses were compared. With one small exception the bigger video seemed to have more impact than the smaller video both for the positive video (clip 2) and the negative video (clip 4), see Table 3 and Figure 2 and 3 (third and fourth treatment setting). A T-test (for two independent samples) showed a significant effect on mood change for the positive clip (clip 2) with $T(24,26)=2.156$, p=0.041 (two-tailed).

Table 3. Video setting: Sample sizes, Means, Standard Deviations and Standard Errors for Mood and Affect Change Scores by treatment

Change scores	Treatment	n	Mean	St. Deviation	Std. Error Mean
Mood change clip2	tv/big video	11	3.55	1.44	.43
	tv/small video	15	.93	3.81	.98
Mood change clip3	tv/big video	11	-5.82	3.68	1.11
	tv/small video	15	-3.07	4.67	1.21
Mood change clip4	tv/big video	11	-2.00	2.10	.63
	tv/small video	15	-2.60	3.04	.79
Affect change clip 2	tv/big video	11	7.27	5.39	1.62
	tv/small video	15	6.40	9.04	2.33
Affect change clip3	tv/big video	11	-13.27	4.86	1.47
	tv/small video	15	-9.73	8.19	2.11
Affect change clip4	tv/big video	11	-8.82	3.82	1.15
	tv/small video	15	-6.73	3.99	1.03

Note:
Statistics for Version 1 of Clip sequence: Clip2=positive; Clip3=instruction; Clip4=negative

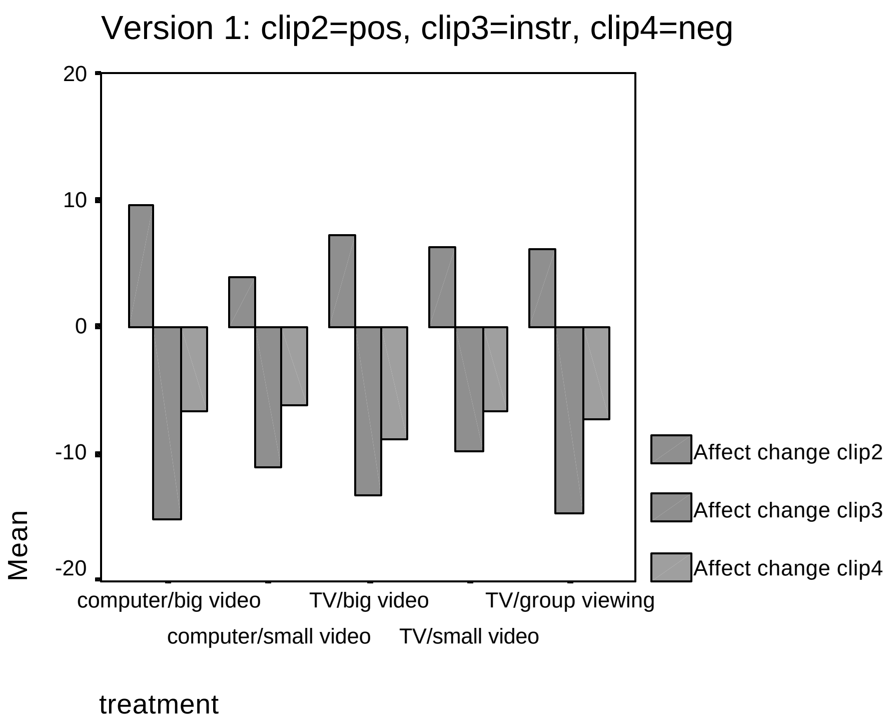

Figure 2: Bar Graph of Mean Change Scores for Mood (Version 1 sequence of video clips)

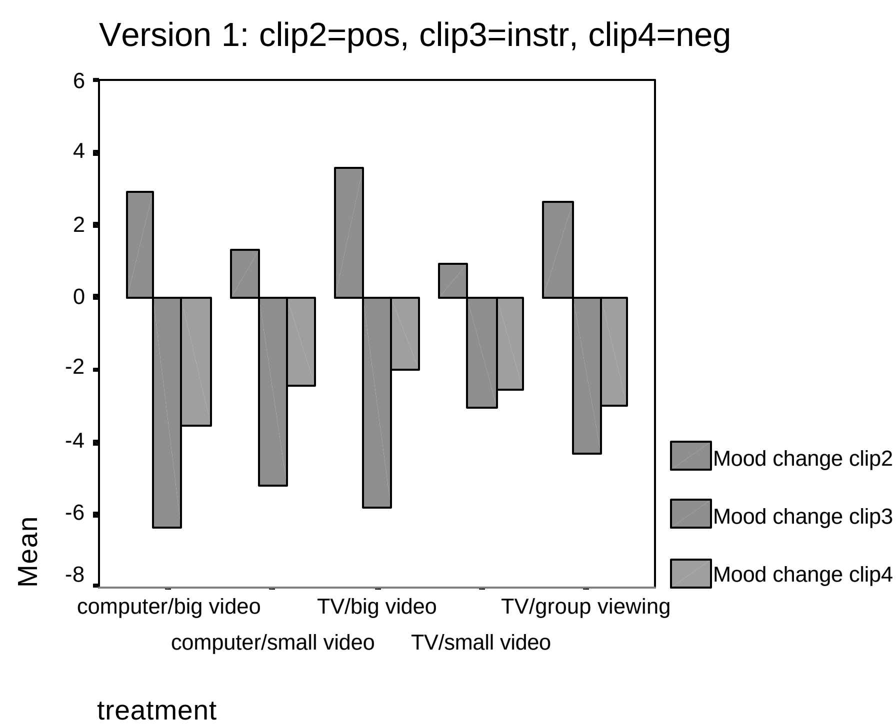

Figure 3: Bar Graph of Mean Change Scores for Affect (Version 1 sequence of video clips)

Within Web-setting: Big versus little video play-back size. In the Web-setting the bigger video play back size (n=14) and the smaller play back size (n=13) were compared. Without exception the bigger playback size always produced a larger mean score for mood change and affect change than the smaller video size as is shown in Table 4 and Figure 2 and 3 (first and second treatment setting). A T-test (for two independent samples), however, showed that these differences were not significant. When we look at the female participants only within the Web-setting (n=9 for both image sizes), we did found significant differences for image size for affect change by the second clip, the positive clip (p=.033, two-tailed) and for the third clip, the slightly negative clip (p=.029, two-tailed).

Table 4. Web setting: Sample sizes, Means, Standard Deviations and Standard Errors for Mood and Affect Change Scores by treatment

Change scores	Treatment	n	Mean	Std. Deviation	Std. Error Mean
Mood change clip2	computer/big video	14	2.93	4.01	1.07
	computer/small video	13	1.31	2.81	.78
Mood change clip3	computer/big video	14	-6.36	5.00	1.34
	computer/small video	13	-5.23	4.21	1.17
Mood change clip4	computer/big video	14	-3.57	3.48	.93
	computer/small video	13	-2.46	2.50	.69
Affect change clip2	computer/big video	14	9.57	7.78	2.08
	computer/small video	13	3.92	7.33	2.03
Affect change clip3	computer/big video	14	-15.21	5.99	1.60
	computer/small video	13	-11.00	5.82	1.61
Affect change clip4	computer/big video	14	-6.64	6.27	1.68
	computer/small video	13	-6.15	2.94	.82

Note:
Statistics for Version 1 of Clip sequence: Clip2=positive; Clip3=instruction; Clip4=negative

Comparisons of media-settings: Web versus television

Although comparisons between media types are difficult to make, because different media and viewing context variables are at stake, we wanted to explore whether media setting (media type plus viewing context) might have effect on the magnitude of affective responses and mood changes. This could be a relevant question for instructors in their media selection process. Therefore the Web-settings and the television settings were compared. First the smaller image sizes and then the larger image sizes in both settings were compared. As mentioned in section 'Design and procedure', we controlled for viewing angle to exclude differences between the settings on this variable. T-Test showed that no significant differences between the media settings were found. A comparison of the small video-playback size in the Web setting (n=9) with a big television monitor applied in a classroom-like presentation (n=10) showed no significant effects. When however the big video playback size (n=14) within the Web-setting was compared with the small television setting (n=15) a significant effect was found. In this case the Web-setting produced more impact on mood state and affective responses than the television setting (p=.049, two-tailed).

Discussion

One of the most powerful characteristics of video media is their potential to evoke emotions. This is one of the reasons why video material is often selected for educational purposes. This study raised the question whether affective video in a WEB-based environment is experienced differently from video in a traditional context and whether video image size is a relevant factor to consider in this context. The key question is in short: "Affective video in a Web: Does it work ?".

We started this paper with the expectations that affective video materials might indeed work when implemented in a Web-based learning environment. Media-setting (Computer[Web] versus television), affective video content (positive versus negative) and image size (big versus small) were the three key factors in the experiment. Another factor, social versus individual viewing situation, was introduced to see whether this is a relevant aspect of the media-setting to consider. For an overview of the treatment groups we refer to Table 1.

The results show that we found evidence for the affective potential of video for both media settings. Only in the individual television setting with the small monitor this effect was not significant on mood changes for the positive video clip as second clip. Also in the Web-environment we found that the affective video materials were effective in evoking affective responses and changes in mood. Again the small positive clip as second clip was the exception to this rule. The reason why the positive clip as second clip did less well in the small image settings, might have to do with the character of the first clip. This clip (documentary about birds) was also experienced as (slightly) positive, which reduced the room for further positive change of mood or affect. The fact that in some cases the smaller video's didn't work, made the question about image size even more relevant. In general, however, we can conclude that affective video materials can be effective when embedded in a Web-based environment.

As far as image size is concerned, in almost all treatment groups the larger image size seemed to have more impact than the smaller video for both affective clips. This 'pattern', however, was only significant for mood change for the positive clip (clip 2) in the television setting. When we looked at the female participants within the Web-setting we did found significant differences (although two tailed) for image size on affect change by the affective video clips (including the third clip). With the relatively small sample sizes (on average n=12) in this study it is, however, not easy to find significant differences between the treatment groups. We suggest for further studies the use of larger sample sizes, controlling for gender, and a broader range of affective clips to explore the image-size issue more in depth. It is, for instance, unknown whether the impact of mood or affect change on performance is subject to threshold levels. Small differences in the amount of change could then be critical, which may add importance to findings such as in this study.

Not only may image size have an impact on affective responses and mood changes, but also on arousal (another aspect of emotion) and attention. A study by Reeves, Lang, Kim and Tatar (1999) about the effects of screen size and message content showed that image size can increase attention and arousal for audio-visual messages. Arousing pictures, like sex and violence for example, produced higher levels of arousal when presented on a large screen than presented on a medium or small screen (screen sizes were respectively 56 inch, 13-inch and 2 inch picture heights). Also larger images were remembered better the smaller images. It would be interesting to explore these issues within a Web-environmental context, also to find out whether Reeves, Lang, Kim and Tatar are right when they state that "The inclusion of display size as an important variable in media research seems critical (p. 64)."

One of our purposes was to explore from an instructors point of view whether a shift from traditional classroom or individual use of video to an individual Web-based learning environment would have an impact on the way in which the same affective video materials are experienced by students. A comparison between the two media-settings in this study (television versus Web) was made. No significant effects were found with one exception: The large videos within a Web-environment evoke stronger affective responses and mood changes than the small television monitor. This might be the case because the image size was perhaps experienced as relatively big because of the short viewing distance to the monitor in the computer setting.

This study could not reveal effects for viewing affective video materials in a group. This was expected, but the actual experimental setting was probably too atypical for a social viewing session because of the procedure and the questionnaires. The session was primarily experienced as a laboratory setting. Laughs or other sounds made aloud were rare. In future research a more realistic viewing situation should be created.

For the measurement of the affective responses and mood states we used Likert-scales for response. A disadvantage of this type of measurement is that it is subjective and that it asks for insight in one's feelings and mood. We would recommend the use of more objective instruments like physical measurement techniques, if available, to contribute to the validity of this type of research.

In conclusion. When we return to the question: "Affective video in a Web: Does it work ?", the answer is that in most cases it does, but with smaller window sizes it might do less well. Which leads for the time being to a general advice for applying videos in the affective domain: Try not to compromise on image size when shooting or selecting affective video materials for the Web.

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A Cognitive Map of Human Performance Technology: A Study of Domain Expertise

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Abstract

Using the Pathfinder Scaling Algorithm (Pathfinder) (Interlink, 1994), the researchers conducted a cognitive task analysis expertise in Human Performance Technology (HPT). The study investigated: 1) the extent to which Pathfinder-derived coherence scores were associated with other measures of HPT expertise; 2) how HPT experts organize their knowledge of the discipline; and 3) how experts organize their HPT knowledge differently than novices. Findings include: 1) a significant correlation between coherence and the number of HPT-related books participants had written; 2) a Pathfinder-derived concept map of HPT; and 3) expected novice/expert differences in Pathfinder similarity and relatedness scores.

Most representations of academic disciplines have been created when experts depict or report what they know. Experts draw diagrams, establish competencies, and write textbooks. Clearly, this approach works; new practitioners use these representations to enter and gain competency in the discipline. Some practitioners eventually master elements of the discipline. However, there are potential problems that can arise when practitioners rely on expert self-report. Simply stated, experts are often unable to state what they know and do that makes them experts. Two cognitive processes account for this phenomenon. First, experts may be unable to explicitly state knowledge they have learned implicitly. Implicit learning occurs when people acquire knowledge about the relationships comprising a complex system, without necessarily knowing in advance what the variables are. Examples include solving differential equations underlying a simulated parking task (Broadbent, Fitzgerald, & Broadbent, 1986) and predicting where a light will appear on a computer screen in a serial learning task (Willingham, Nissen, & Bullemer, 1989). In these situations, people have encountered a complex task, observed the variables in operation in an unselective manner, and attempted to store the contingencies among them (Berry, 1993). Essentially, people implicitly learn these complex system and the relationships comprising it by "mucking about." One of the results of implicit learning is that the resulting knowledge is relatively inaccessible to free recall (Berry, 1993). Experts who have implicitly constructed domain-specific knowledge may not be able to articulate what they know.

Second, experts may be unable to articulate cognitive processes that have reached a level of automaticity. According to Anderson (1993), this situation exists when people explicitly learn new skills or knowledge by using language to mediate a cognitive production, such "determine the cause of a performance gap" or "select an appropriate intervention to address the cause of the gap." With successive tuning, the production fires automatically, without invoking any mediating language. The result is automatic, fluent performance—without the ability to report on the cognitive aspects of the performance itself.

One way to avoid potential problems associated with expert self-report is to employ cognitive task analysis methods. The Pathfinder Scaling Algorithm is one such method (Schvaneveldt, 1990; Interlink, 1994). This software program transforms participants' pair-wise ratings of related concepts into a semantic network—a concept map comprised of nodes (the concepts) and links that depict the relationships among the concepts.

A Pathfinder-derived concept map of a discipline could supplement existing representations created using expert self-report. One opportunity for using Pathfinder to map a discipline lies in the area of human performance technology (HPT): "…a set of methods and procedures, and a strategy for solving problems, for realizing opportunities related to the performance of people. It can be applied to individuals, small groups, and large organizations" (ISPI, 2001). As no cognitive task analysis of HPT has been conducted to date, this study sought answers to the following three research questions:

1. To what extent are Pathfinder-derived coherence scores associated with other measures of HPT expertise?
2. How do experts in the field organize their knowledge of HPT?
3. To what extent do experts organize their HPT knowledge differently than novices?

Literature Review

This section defines key Pathfinder concepts and addresses the literature relevant to each of the study's research questions. In addition to generating concept maps that represent domain knowledge without the complications associated with expert self-report, Pathfinder generates three measures employed in this study: coherence, relatedness, and similarity. Table 1 describes these measures.

Table 1
Definition, Uses, and Examples of Coherence, Relatedness, and Similarity Scores (adapted from Villachica, 2000)

Measure	Definition	Uses	Examples
Coherence (Theoretical Range = -1.0 to +1.0)	A Pearson Product-Moment correlation indicating the internal consistency of ratings within an individual's or group's set of concept ratings (Interlink, 1996).	A coherence score for an individual's or group's set of concept ratings calculated. This score is compared to that of other individuals.	Student coherence scores obtained prior to instruction are compared to those obtained after instruction to determine if learning occurred.
Relatedness (Theoretical Range = -1.0 to +1.0)	The Pearson Product-Moment correlation between sets of concept ratings (Interlink, 1996).	The comparison of an individual's or group's set of concept ratings to another's.	The proximity matrices of students are correlated with a referent matrix containing the averaged responses of a panel of experts.
Similarity (Theoretical Range = 0 to +1.0)	The proportion of shared links in two concept maps using the same terms. The ratio of shared neighborhoods in two Pathfinder networks (Interlink, 1996).	The Pathfinder networks of an individual or group are compared to those of another.	The Pathfinder networks of students are compared to their instructor's. The resulting similarity scores are used to predict performance on a test.

Coherence and Expertise

Since the knowledge structures of experts are more organized than those of novices, experts in a given domain should possess relatively higher coherence scores. The higher the coherence score, the greater the internal consistency of the concept ratings. Four studies have investigated the relationship between coherence and expertise in different domains. However, results have been uneven, indicating a need for additional replication.

Three of these studies found a correlation between coherence and expertise. In a classroom setting, Housner, Gomez, and Griffey (1993) investigated the extent to which coherence scores and other knowledge structures would predict performance in a physical education preservice course. They found a moderate correlation between coherence and a simulated teaching activity ($\underline{r} = .63$). Gaultieri, Fowlkes, and Ricci (1996) investigated the effectiveness of training that eight Navy and Air Force pilots received over a five-day workshop. This training consisted of pre-briefings, simulated missions, and debriefings. The pilots were divided into two teams of four pilots each, with each participants rating concept pairs on the first, third, and fifth days. Results of a repeated measures analysis of variance revealed a statistically significant increase in participants' coherence scores over time ($\underline{f}2,14 = 11.55$. $\underline{p} < .001$). In a similar study, Stout, Salas, and Kraiger (1997) studied 12 naval aviator trainees enrolled in a one-day, complex training program addressing aviation teamwork and communication skills. The researchers reported that course attendees earned higher mean coherence scores than a control group who received no training ($\underline{t} = 2.70$, $\underline{p} < .01$, $\underline{M}_{\text{traineees}} = .63$, $\underline{M}_{\text{control}} = .26$).

One study did not find a relationship between coherence scores and domain expertise. Dorsey, Campbell, Forste, and Miles (1999) used Pathfinder networks to create concept maps that evaluated relationships generated by 88 computer users and compared them against the scores of four subject matter experts. Their results indicated that coherence scores were not significantly related to any of the concept map scores.

Within the domain of HPT, coherence scores would conceivably be positively correlated with several measures of expertise. Experts in HPT are members of a community of practice that has its roots in academe. As a result, experts can be expected to present at conferences, write articles, and author books. They can be expected to have spent at least 10 years developing their expertise (Ericsson, 1996).

Organization of HPT Domain Knowledge

The organization of HPT domain knowledge can be viewed in terms of existing expert representations of the domain and the extent to which a Pathfinder-generated concept map could supplement these existing models.

Existing expert representations of HPT. Given the depth and breadth of HPT, a variety of experts have authored conceptual and procedural representations of the discipline. Each representation depicts an expert's organization of his or her HPT expertise. Conceptual representations place HPT within theoretical contexts and illustrate the relationships among its components. Procedural representations illustrate the steps comprising an HPT process.

Stolovitch and Keeps (1999) provide both conceptual and procedural representations of HPT. In their conceptual model, the authors depict external and organizational environments that influence internal requirements related to human performance. Once articulated, these requirements trigger behaviors that produce accomplishments, which are subjected to verification. Accomplishments that are aligned with business requirements are accepted; those that are not aligned are subjected to subsequent alteration in behaviors, which change the organization's accomplishments. Their procedural representation of HPT consists of an iterative, 10-step process that begins with the identification of business requirements and concludes with monitoring and maintaining performance interventions. At this point, the process can repeat itself, leading to the identification of new requirements and subsequent interventions.

Addison (2001) provides a conceptual view of HPT in his Performance Consultant HPT Landscape. This representation of the discipline depicts the interaction of two conceptual and two procedural dimensions that comprise the landscape:

1. Levels of the environment, ranging from the worker to society (conceptual);
2. Principles of performance technology (conceptual);
3. Systematic approach, starting with need and ending with evaluate (procedural); and
4. System(s) view point, beginning with conditions and ending with feedback (procedural).

The International Society for Performance Improvement has created its own procedural representation of HPT. This process model focuses on a systematic combination of performance analysis, cause analysis, and intervention selection (ISPI, 2001). The majority of steps comprising the HPT model contain additional conceptual information providing additional detail about a given step.

Pathfinder representations of expertise. In addition to the conceptual and procedural representations used to depict expert's organization of HPT, one can use Pathfinder networks to represent this domain-specific expertise. The end result of Pathfinder analysis is a concept map that depicts a semantic network representing a domain, such as HPT. These concept maps are intended to represent the knowledge structures that humans store in their minds (Jonassen, Beissner, & Yacci, 1993).

Researchers have employed Pathfinder-derived concept maps to study the nature of expertise in some 13 studies and nine different domains, ranging from aircraft combat to programming to electronic troubleshooting to medicine (Villachica, 2000). In a similar vein, Pathfinder-derived concept maps could depict the way in which HPT experts organize their domain knowledge, providing another representation of this complex discipline.

Novice/Expert Differences in the Organization of HPT Knowledge

It is not surprising that novices and experts exhibit different levels of domain-specific performance. A well-established line of research traces the sources of these performance differences to the organization of cognitive structures in memory. De Groot (1978) and Chase and Simon (1973) demonstrated that expertise in chess is partially attributable to the organization of memory. Chess masters possess more highly organized and complex structures in long-term memory than chess experts, who possess more organized and complex structures than non-experts. These differences in domain knowledge allow chess masters to employ a larger visual scan than chess novices (Reingold, Charness, Pomplun, & Stampe, 2001). Similarly, Chi, Feltovich, and Glaser (1981) report that physicists sort physics problems differently than novices, with experts' organizational strategies revealing more sophisticated cognitive structures, based upon their knowledge of the "deep structure" of the domain.

Pathfinder-related studies that address novice/expert differences in domain-specific cognition have found that experts tended to exhibit greater degrees of intragroup agreement than novices. That is, the relatedness, similarity, and coherence scores of experts tended to be more similar than those of novices. For example, Schvaneveldt, Durso, Goldsmith, Breen, and Cooke (1985) conducted a discriminant analysis using Pathfinder measures that successfully predicted novice and expert performance in a fighter pilot task. Schvaneveldt, Durso, and Dearholt (1989) employed Pathfinder-produced concept maps to study differences in the ways in which biology graduate students ("experts") and undergraduate students ("novices") organized their knowledge of biology. Schvaneveldt, Beringer, Lamonica, Tucker, and Nance (2000) used Pathfinder to demonstrate differences in the priorities that novice and experienced commercial aircraft pilots assign to information viewed during the phases of a flight. Thompson (1992) employed Pathfinder-based measures to reveal differences in the organization of domain knowledge among expert, non-expert, and novice nurses.

Given the consistency of these findings, one should expect to find novice-expert differences in the organization of HPT knowledge. That is, the Pathfinder-related measures of an operationally defined set of experts should be more like each other than they are like those of a set of novices.

Methodology

Participants and Procedure

ISPI issued invitations to participate in the study to approximately 4,500 of its 6,000 members (75 percent). ISPI published the invitations on two occasions, the first invitation in its online newsletter ISPI Quick Read. After 14 days, only 38 people had responded to this invitation. ISPI then emailed a second invitation to its members two weeks later. With this invitation, another 103 persons had responded, making a total of 141. Of those, 4 people had submitted duplicate data sets, which were subsequently removed from the study. Of the 137 people who had completed the survey, 73 went on to complete all 435-concept ratings. Thus, the overall response rates to the study were 2 and 1 percent, respectively.

The researchers drafted an initial list of 50 HPT-related concepts based upon a review of the Handbook of HPT (Stolovitch & Keeps, 1999). Acting as the operationally defined referent experts for the study, the ISPI 2000-2001 Board participated in a modified Delphi process that resulted in a final list of 30 HPT concepts that would be employed in the study. ISPI members were invited to participate in the study via two methods. One, a general announcement was published in the ISPI Quick Read newsletter, and second, individual invitations were emailed. The second section of both the ISPI Quick Read article and the email invitation contained an informed consent form. Subjects who agreed to participate in the study indicated their agreement by clicking on a link that directed them to a website used to collect demographic data and concept ratings. In order to maintain confidentiality, all data were aggregated into a single computer file using the computer to assign unique, anonymous participant identification codes. Once subjects had entered their responses into an online dataset, all names were deleted from the file, thereby guaranteeing the anonymity of all participants and protecting subjects against unintentional disclosure outside the experiment.

The website consisted of the several pages, which participants completed in order. After viewing a welcome page that described the purpose of the study, participants viewed instructions about rating HPT concepts. The practice component comprised of the next two pages of the web site. In the first page, participants then viewed a list of practice terms, which appeared next to radio checkboxes. Participants could click next to any term they did not know. In the next page, participants completed a set of practice ratings. The survey component of the web site consisted of a single web page that participants completed to provide information about themselves. The ratings component of the web site consisted of two pages. In the first page, participants viewed the complete list 30 HPT concepts; with the option to check any terms they did not know. In the next page, participants rated up to 345 randomly presented pairs of HPT concepts, checking on the radio buttons comprising a rating scale to assign lower numbers (1-4) to unrelated pairs and higher numbers (6-9) to related pairs. Participants assigned a “5” to concept pairs they did not know or could not rate. The last pages of the web site thanked participants and allowed them to view additional information about the HPT Research Group conducting the study. The concept ratings participants provided were then stored as proximity matrices for subsequent Pathfinder analysis.

Results

Coherence and HPT Expertise

Table 2 summarizes the measures, survey items, number of respondents, means, standard deviations, and standard errors used in the regression analysis of coherence scores.

Table 2

Descriptive Statistics Used in the Regression of Coherence Scores on Measures of HPT Expertise

Measure	**Item**	**Statistics**
Coherence scores	Not applicable	N = 73 M = 0.324 SD= 0.153
Years HPT practitioner	How many years have you been a practitioner of human performance technology?	N = 137 M = 11.161 SD = 8.239
Number of juried presentations	How many JURIED presentations relating to HPT have you written or co-written?	N = 137 M = 3.321 SD = 11.758
Number of non-juried presentations	How many NON-JURIED presentations relating to HPT have you written or co-written?	N = 137 M = 4.409 SD = 8.839
Number of juried articles	How many JURIED articles relating to HPT have you written or co-written?	N = 137 M = 0.744 SD = 3.097
Number of non-juried articles	How many NON-JURIED articles relating to HPT have you written or co-written?	N = 137 M = 2.007 SD = 6.026
Number of book chapters	How many book chapters relating to HPT have you written or co-written?	N = 137 M = 0.774 SD = 3.132
Number of books	How many books relating to HPT have you written or co-written?	N = 137 M = 0.197 SD = 1.028

To determine the relationship between Pathfinder coherence scores and other measures of expertise, the researchers employed a multiple linear regression analyses that regressed coherence scores on the number of years as an HPT practitioner, number of juried presentations, number of non-juried presentations, number of juried articles, number of non-juried articles, number of book chapters, and number of books the participant had either written or co-written. To control for Type I error, alpha was set at .05. All variables were entered at once. The multiple linear regression produced statistically significant results (r = .458, p = .026), accounting for 21 percent of the variance in coherence scores. As depicted in Table 3, the only statistically significant independent variable contained in the equation was the number of books the participant had written or co-written. The other independent variables did not reach levels of statistical significance. The magnitude of this correlation is weak, although it approaches the moderate threshold of .5.

Table 3

Regression Analysis Summary for HPT Expertise Variables Predicting Coherence Scores

Variable	**Coherence (n = 73, r^2 = . 0.210)***		
	B	**SE B**	β
Years HPT practitioner	0.0006	0.002	0.027
Number of juried presentations	-0.0005	0.007	-0.012
Number of non-juried presentations	-0.0049	0.007	-0.149
Number of juried articles	0.0056	0.029	0.033
Number of non-juried articles	0.0098	0.013	0.126
Number of book chapters	-0.0025	0.016	-0.020
Number of books	0.2747	0.067	0.468*

p < 0.05

It should be noted, however, that only 9 of 137 participants who responded to this item on the demographic survey had written a book. Stevens (1992) notes that statistical procedures based upon regression are mathematical maximization procedures may capitalize on chance and artificially increase alpha, especially when the number of subjects is not large relative to the number of variables. Thus, the results obtained in this study may not replicate in another sample.

Organization of HPT Expertise

As a measure of the internal consistency of a participant's concept ratings, coherence scores can be used as an operational indicator of domain expertise (Interlink, 1994). To identify the participants who would act as the expert HPT practitioners in this study, the researchers identified all participants with coherence scores greater than 0.4 (n = 21, M = .4976, SD = .1309) (Schvaneveldt, personal communication, June 23, 1998). The researchers then averaged the concept ratings of these operationally defined experts and subjected the results to Pathfinder analysis, which produced the following concept map. Figure 1 represents the organization of a statistically derived, "averaged expert's" cognitive organization of HPT.

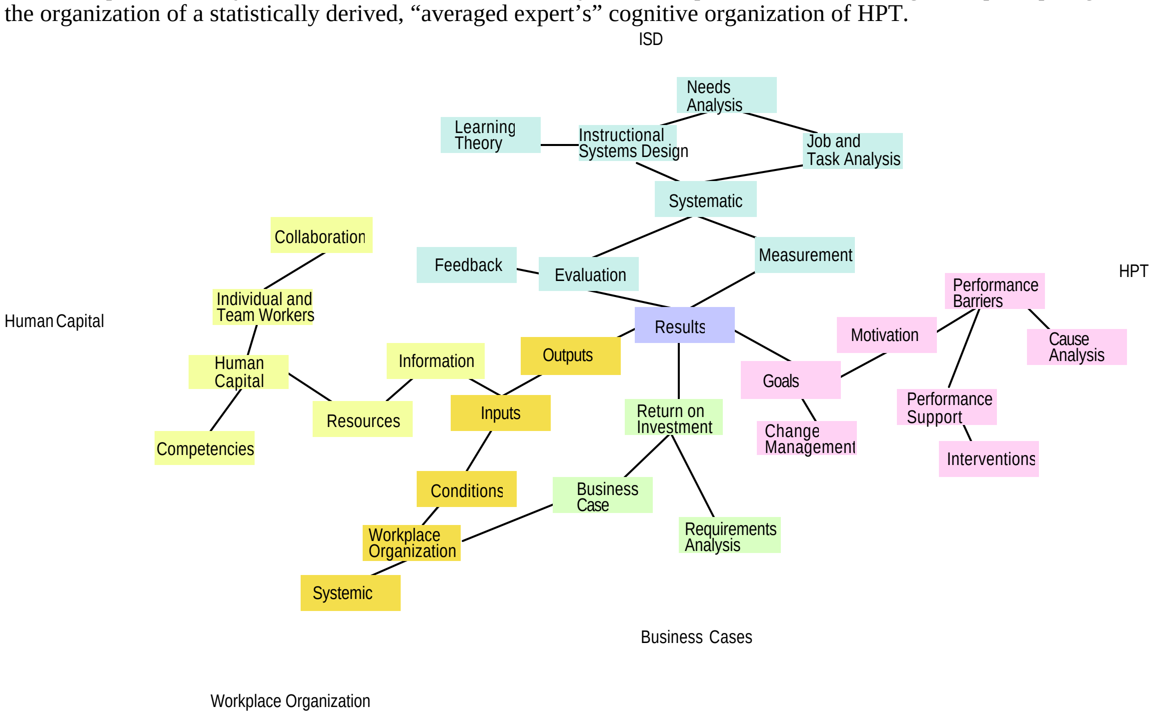

Figure 1. Expert Concept Map

The key concept in the map is represented by "*results*," which is linked to four other sets of concepts. The *first* set branch of concepts contains the terms "*learning theory*, "*ISD*," "*needs analysis*," "*job and task analysis*," "*systematic*," "*measurement*," "*evaluation*," and "*feedback*." The organization of these concepts indicates that experts employ ISD and its related components to obtain results. The *second* branch of concepts related to "*results*" contains the terms "*goals*," "*change management*," "*motivation*," "*performance barriers*," "*cause anal*ysis," "*performance support*," and "*interventions*." These terms form the basis of HPT theory and reflect its behavioral roots. The organization of these concepts indicates that experts employ HPT theory to obtain results. A *third* branch of concepts related to "*results*" contains the terms "*Return on Investment*", "*business case*," and "*requirements analysis*." Experts use requirements analysis to build business cases from which they can predict a return on investment that quantifies obtained results. The organization of these items indicates that experts employ business-related measures to obtain results. A *fourth* branch of concepts related to "*results*" is more complex and consists of two separate subsets. The first subset consists of the terms "*outputs*," "*inputs*," "*conditions*, "*work organization*," and "*systemic*." Systemically accounting for workplace organization, experts assess the conditions of performance, their inputs, and their outputs in determining performance results. It is also important to note that "*workplace organization*" is also linked to "*business case*," indicating that experts use the context of the workplace to create such cases. The second subset consists of the terms "*information*," "*resources*," *human capital*, "*competencies*," "*individual and team workers*," and "*collaboration*." The organization of these terms indicates that collaboration among individual and team workers builds human capital, which can be described in terms of competencies. Human capital is linked to resources. Information about resources allows resources to be used as inputs to performance-which ultimately lead to outputs and results.

Novice/Expert Differences in the Organization of HPT Knowledge

To explore differences in the organization of HTP knowledge among an operationally defined set of novices and experts, the researchers employed a median split. In this instance, experts were operationally defined as any participant possessing a coherence score one standard deviation above the mean (n = 8, M = .1035, SD = .0553). Novices were operationally defined as any participant possessing a coherence score one standard deviation below the mean (n = 8, M = .1353, SD = . 0161). Table 4 summarizes means and standard deviations associated with experts' and novices' similarity and relatedness scores.

Table 4
Numbers, Means, and Standard Deviations for Novice and Expert Similarity and Relatedness Scores

Group	**Measure of Knowledge Organization**					
	Similarity Scores			Relatedness Scores		
	N	M	SD	N	M	SD
Expert	8	0.1353	0.0553	7	0.0659	0.0421
Novice	8	0.1035	0.0161	8	0.0322	0.1122

To determine if the similarity and relatedness scores of experts were more similar to each other than they were to novices, the study employed a multivariate analysis of covariance (MANCOVA). Novice/expert designation acted as the independent variable. Similarity and relatedness scores acted as the dependent variables. As coherence scores were used to operationally define groups and represented a source of variation beyond the control of the researchers, they were used as a covariate in the analysis. To control for Type I error, alpha was set to .05.

The results of the MANCOVA indicated that the group effect was statistically significant (Wilks' Lambda = .544, $f(1, 14) = 4.615$, $p = .035$). Eta-squared (1-Wilks' Lambda) revealed that approximately 46 percent of the variance in the linear combination of the dependent variables was associated with group differences. As summarized in Table 5, tests of between-subjects effects revealed that group differences were attributable to similarity scores alone.

Table 5
MANCOVA Results for Similarity and Relatedness Scores as a Function of Group and Coherence

Source	**Dependent Variable**	**df**	**SS**	**MS**	**f**
Covariate (Coherence)	Relatedness	1	0.0035	0.0035	.439
	Similarity	1	0.0065	0.0065	5.820*
Group	Relatedness	1	0.0065	0.0065	.816
	Similarity	1	0.0110	0.0110	9.803*
Residual	Relatedness	12	0.0952	0.0079	
	Similarity	12	0.0135	0.0011	
Total	Relatedness	15	.137		
	Similarity	15	.249		

* *p < 0.05*

Discussion

Coherence and HPT Expertise

Although the number of years participants had been a HPT practitioner was expected to weakly correlate with participants' coherence scores, it did not. Although the sample exceeded Ericsson's (1996) threshold of ten years to reach expert status in a domain, no correlation with coherence scores or any other measure of expertise was found. Since the number of non-juried/juried presentations and publications are based upon recognition in the field and the results of peer review, it was thought that these indirect measures of HPT expertise would correlate with coherence scores. Although these measures correlated among themselves, they did not correlate with coherence; book production alone correlates with coherence.

Three possible explanations for the significant relationship between coherence scores and authoring an HPT-related book include: 1) desire to create detailed conceptual structures or schemas, 2) tolerance for tedium, and 3) low sample size. The correlation between coherence scores and writing an HPT-related book could be the result of the capacity or desire of an author to develop highly detailed and organized cognitive structures or schemas. Books are representations of schemas, divided into chapters and sections. Perhaps book authors possess such schema, making it more likely that their cognitive maps would correlate with coherence scores.

Another conceivable reason for the correlation between book authorship and coherence scores may be book authors' tolerance for tedious activity. Authoring depends on patience, self-discipline, and a large devotion of time and energy. Authoring also requires one to switch attention between small details and large-picture views frequently. The structure of this study's pair-wise rating activity required the same sort of mental activity for an extended period of time (between 30 minutes and one hour). Perhaps individuals who were able to complete the ratings and stay on task for this time are also individuals who can author books.

Finally, the low sample size employed in the study may have precluded obtaining significant results. In addition to artificially increasing alpha, low sample size may have lacked adequate statistical power to detect otherwise significant relationships between coherence scores and measures of HPT expertise. Replicating this study with a larger sample and modifications to the website to decrease experimental mortality (that is, the number of participants who dropped out of the study between completing the information page and their concepts) could produce less ambiguous findings.

Organization of HPT Expertise

The expert concept map is similar to other expert representations of HPT, suggesting the convergent validity to this finding. The information and resource components of the human capital branch of the concept map roughly correspond to the organizational environment of Stolovitch and Keeps' (1999) conceptual representation of HPT. The business case branch corresponds to their components of business goals/objectives and internal requirements. Where Stolovitch and Keeps focus on accomplishments and their verification, the expert concept map focuses on results. Additional similarities can be found comparing the expert concept map to Stolovitch and Keep's procedural representation of HPT. The business case branch of the concept map addresses Stolovitch and Keeps' steps for identifying business and performance requirements. Likewise, the HPT branch of the concept map addresses the steps "define performance gaps, specify gap factors, and select interventions."

One of the underlying principles of the HPT landscape model (Addison, 2001) is a focus on results and outcomes. The expert concept map also communicates a focus on results, which is the key concept on the map. Sections related to ISD, human capital, business cases, and HPT are linked to obtaining results. The systems and business case portions of the Addison model are similar to the ISD systems and business case branches of the expert concept map. The predictive validity of the expert concept map could be determined by determining the extent to which it predicts performance in HPT. For example, concept ratings could be obtained from previous winners of ISPI awards. These scores could be compared against a control group who did not win such awards. Subsequent statistical analysis could determine the extent to which Pathfinder-derived relatedness, similarity, and coherence scores predicted the award-winners. In addition to providing a unique perspective of HPT as a discipline, practitioners and researchers could employ the concept map in different ways. For practitioners, the expert concept map can assist in the creation of HPT competencies. The different branches of the map could represent the major HPT competencies. The organization of subordinate and related competencies could also be derived from the concept map.

Experienced practitioners could use the concept map as a "mind tool" to introduce new practitioners to HPT. Specifying the nature of the links could help learners construct their knowledge of the discipline (Jonassen, 2000). The similarity measure that Pathfinder derives from the concept map could also be used as an assessment tool for practitioners and researchers alike. As new practitioners gain experience solving increasingly difficult problems in the domain, their similarity scores should increase, indicating that their mental map of HPT is increasingly like those of experienced practitioners. Their development within this community of practice could be modeled statistically, with different stages of practitioner HPT development lending themselves to different learning and other types of performance supporting interventions. If such stages and interventions could be determined, then whole programs could be designed to help novices move along a continuum of HPT expertise, potentially improving the quality of HPT practice while decreasing the time required obtaining expert-like performance.

Novice/Expert Differences in the Organization of HPT Knowledge

The similarity scores of experts are higher than those of novices, indicating that expert concept maps are more like those of other experts than of novices. This finding replicates the results of other studies comparing the organization of expert and novice cognition. Specifically, experts share a greater proportion of the links in their individual concept maps with those of the "averaged expert's" concept map (p. 8) than do novices (14 percent versus 10 percent, respectively). It should be noted, however, that the small sample used in this analysis may not provide replicable results.

Conclusion

While the results obtained in this study are intriguing and suggest potential uses of the expert concept map and related Pathfinder-based measures in HPT, these results are based upon a small sample. Replication with a larger sample is certainly warranted.

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The Relative Effectiveness Of Structured Questions And Summarizing On Near And Far Transfer Tasks

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Abstract

This study is to compare the effect of two learning strategies: summarizing and structured questions on near and far transfer tasks. The hypothesis is that the structured questions will better activate metacognitive and critical thinking skills than summarizing so that it will better facilitate learning transfer. However, the results do not show any significant difference between two strategies on transfer tasks. Possible reasons that the students failed to activate metacognitive skills or critical thinking skills are discussed. Recommendations to maximize the effect of structured questions on transfer tasks are also discussed.

Introduction

Various studies (Sternberg & Frensch, 1993; Salomon & Perkins, 1989; Perkins & Grotzer, 1997; Kosonen & Winne, 1995; Stolovitch & Yapi, 1997) have been conducted in the field of educational research in general, and instructional systems design in particular, on how to facilitate transfer of learning. The early research on learning transfer focused on the role of practice. Most early researchers agreed that increased amounts of practice would increase transfer (Thorndike, 1913; Gagne & Foster, 1949; Hovland, 1951). More recently, one major interest is the role of metacognitive strategies and critical thinking in learning transfer. Most of the research focused on teaching metacognitive strategies and critical thinking skills. However, relatively little research has focused on the activation of metacognitive strategies and critical thinking skills that ultimately promotes learning transfer (Forster, 1996).

This study explores the possible way to activate metacognitive strategies and critical thinking skills through the use of reflective activities, like summarizing or answering structured questions after reading. Metacognitive strategies refer to the regulation and control of cognition. Despite differences, most researchers would agree critical thinking involves the intentional application of rational, higher order thinking skills that include analysis, synthesis, problem recognition and problem solving, inference, and evaluation (Angelo, 1995). Structured questions in this study refer to a set of generic questions that are not associated with specific content of any articles. Also, this research studies the effect of metacognitive and critical thinking skill activation on near and far transfer. Near transfer is the application of learning to situations similar to those in which initial learning has taken place. In contrast, far transfer is the application of learning to situations dissimilar to those of the original learning events.

The purpose of this study was to compare the relative effectiveness of structured questions and summarizing on near and far transfer tasks. More specifically, this study was designed to address the following questions:

1. Will students who answer specific structured questions perform better on near transfer task than students who are simply asked to summarize the content?
2. Will students who answer structured questions perform better on far transfer task than those who only write a summary of an article?

It was expected that students who write reading reactions based on structured questions would outperform significantly those students who only write a summary of an article. This was because the structured questions in this study are higher order cognitive questions, which might stimulate the development of students' cognitive strategies beyond simply memorizing content (Sanders, 1966). In other words, the structured questioning format requires the use of more metacognitive strategies and critical thinking skills. It requires not only analyzing skills but synthesizing, judging, and evaluating skills. As a result, the students who answer structured questions might have a better retention of the content while applying what they have read than those who only summarize the content. With the better retention, the structured questions group might do better on near transfer task.

It was further expected that the structured questions group will perform significantly better on far transfer task than the summary group. This is based on the fact that structured questions in this study might activate the application of analyzing, synthesizing and evaluating skills that are part of metacognitive strategies, and critical thinking skills. This is a kind of skill activation (Salomon, 1979). According to some researchers (King, 1992; Pressley, Wood, Woloshyn, Martin, King, & Menke, 1992), generic questions (or structured questions in this study) are very effective at promoting critical thinking skills because they will induce inference, evaluation, and verification. The writing of an EPSS (Electronic Performance Support Systems) product evaluation report, as a far transfer task, also involves applying synthesizing and evaluating skills. In contrast, although summarizing may also involve cognitive strategy activation, most people will focus on content learning when they summarize (Garner, 1987).

Method

Participants

Sixty-six undergraduate students (7 males, 59 females) from a class of 101 students at Florida State University participated in the study as a part of an outside class assignment and a class activity. Although 101 students participated in transfer tasks (as a class activity), only 66 students submitted the outside class reading assignment. So the final result was based on the 66 students who participated in both activities in this study. Most students are sophomores or juniors who major in or plan to major in elementary, special, and early childhood education. All the students were enrolled in a course entitled Introduction to Educational Technology. Some students may know of the term CBT (Computer-Based Training), but they had never been exposed to the idea of EPSS (Electronic Performance Support Systems), the content topic of this study. The students' participation in this study was assigned as part of their class activities. They did not get any extra credit points for participating, and their participation in this research study did not affect their grade or any negative consequences.

Materials

Two articles about Electronic Performance Support Systems (EPSS) were used for the reading assignment. EPSS is an interactive computer-based environment that provides on-the-job and just-in-time support to facilitate task performance and product development. It usually consists of a library and information support system, customized tools, learning function, and an interactive expert system. The first article is Leighton's (1996) *What is an EPSS*? It introduces the background, definitions, goal, and components of EPSS. The other is Sleight's (1993) *What is Electronic Performance Support and What Isn't?* In the article, Sleight identifies major characteristics of EPSS and compares examples and non-examples of EPSS. Both articles are four pages long with about 1500 words.

The EPSS product the students evaluated for the far transfer task is the Florida Curriculum Planning Tool (CPT) version 2.0. CPT was designed and developed by the Center for Performance Technology at Florida State University for the Florida Department of Education (DOE). The purpose of CPT is to facilitate teachers' planning of learning activities and units of instruction that are in compliance with Florida Sunshine State Standards. It is designed, in particular, to assist teachers in developing learning activities for any subject, grade level, strand, theme, standard, benchmark or any combination of the above. It also allows teachers to import activities developed by other teachers, and export activities they develop to share with others.

Independent Variable

The independent variable in this study is the type of reading assignment, which had two formats. One format requires the student to write reading reactions based on the given structured questions. These questions include:

- What are your gut reactions to the article?
- What do you think are the big ideas in this article?
- What are the implications for your (future) teaching or work?
- What are the implications for your learning?
- What questions does it leave unanswered?
- What is your rating of the usefulness of this article? Choose one of the following: (poor, fair, good, excellent)

The other format requires students to write a summary of the article in a free format.

Dependent Variables

The two dependent variables are near transfer and far transfer. The measurement of near and far transfer is the score on the writing of a list of EPSS evaluation criteria (near transfer) and the score on the CPT evaluation report (far transfer). The score of the EPSS evaluation criteria is determined by the number of evaluation standards that are included in the student's evaluation based on the ideas from the two EPSS articles. The total possible score is 15, representing fifteen major points mentioned in the two articles about the characteristics of an EPSS. The score on the CPT evaluation report is determined by the following assessment criteria. These criteria are adopted and modified from the principle of authentic writing assessment (Chapman, 1990; Hart, 1994; Frederiksen & Collins, 1989). The authentic writing assessment examines a student's writing holistically. One major characteristic of this method is that the students' total scores consist of scores representing different dimensions which include content, organization, style, and mechanics. The formal writing assessment usually emphasizes writing style, mechanics of spelling and syntax, and content. However, in this study, the focus was on the content. This is because the content in the final evaluation report should reveal how well they have learned from the reading assignment, and whether any transfer has occurred. Four dimensions are used to score the evaluation report. They are listed below.

1. Focus: the main idea, theme, or point of view is clear and consistently maintained, overall recommendation about the product included. (0-3)
2. Support: arguments and conclusions are adequately supported and explained. (0-3)
3. Organization: the logical flow of ideas is clear and related. (0-3)
4. Content: Number of major points mentioned in the EPSS articles included. (0-6)

On the basis of the above definitions, more detailed scoring principles were developed for each dimension. A three-point scale was used for the first three dimensions of Focus, Support, and Organization. A six-point scale was used for the dimension of Content because the content was the key factor that was associated with the transfer of learning in this study. Thus, the total possible score for the far transfer task is 15 points.

Procedure

At the beginning of the course, the students were told about the study. The participants were randomly assigned to one of two groups: one was told to write reading reactions based on the structured questioning format, the other was told to write summaries of the articles in a free format. The experiment began in the third week of class. Both groups were asked to read two articles on the topic of EPSS, and then either answer structured questions or write a summary as an outside class assignment. They were required to submit their reading assignments at the beginning of the fourth week class. During the fourth week of class, the students were required to do two tasks in class, in an hour, without access to other materials. The first task was to write a list of an evaluation criterion for evaluating EPSS products based on what they had read. The second task was to write an evaluation report of the CPT. The students finished these two tasks in front of the computer in the computer lab. They were asked to browse the CPT first and write down their evaluation in essay format. The evaluation criteria and report were collected by the researcher after the class.

The students' evaluation reports were scored by the researcher and another doctoral student whose major is measurement and testing in the College of Education. Both raters have experience in teaching and writing assessment. The following procedure was used in scoring the students evaluation criteria and the evaluation report of CPT. Before starting the grading process, the raters read two EPSS articles and the exercise instructions to get familiar with the content and purpose of this study, which was very important for another rater. The researcher assigned the numbers one to sixty-six to participants for scoring purposes. Neither rater knew the student's treatment group when grading his or her writing so as to avoid any bias to a specific group. Based on the scoring guide for grading, the two raters tried to score three evaluation reports together as a test. They then discussed the differences and came to a consensus for further grading. Finally, the two raters finished grading all sixty-six evaluation reports individually. To ensure the reliability and consistency between the two raters, correlation coefficients for both scores were calculated using the statistical software package, SPSS. The results are shown in Table 1.0. Pearson's correlation coefficients for the two scores are .80 and .73. They are both statistically significant at the .01 level.

After finishing the scoring, the researcher averaged the two raters' given scores as the final score for each student. Two scores of each student on near and far transfer tasks were then input into the SPSS data worksheet for data analysis.

Table 1.0 Correlations Between Two Raters on Transfer Task Scores

Correlation	Rater	A	B
Evaluation Criteria	A	1.00	0.80
	B	0.80	1.00
Evaluation Report of CPT	A	1.00	0.73
	B	0.73	1.00

Note. Correlation is significant at 0.01 level.

Results

Relative Effectiveness on Near Transfer Task

The score of each student's performance on near transfer task was measured by the number of key points included in their list of evaluation criteria. The possible total score is 15, which represents 15 key points mentioned in the two EPSS articles. Table 2.0 presents the means, standard deviations, and range of scores for the students' EPSS evaluation criteria. The average score of the structured questions group (M = 3.35) was lower than the average score of the summary group (M = 3.85), but the difference was not statistically significant, $F(1, 64) = 2.257$, $p > .05$.

Table 2.0 Mean Scores of Writing a List of Evaluation Criteria

Measure	Group	N	M	SD	Range
Evaluation Criteria	Structured Question	34	3.35	1.00	2.00-7.00
	Summary	32	3.86	1.68	1.00-9.00
	Total	66	3.60	1.38	1.00-9.00

Note. The possible total score for evaluation criteria is 15 points.

Relative Effectiveness on Far Transfer Task

The student's performance on the far transfer task was determined by their evaluation report of Curriculum Planning Tool (CPT). The evaluation report was in essay format. The scoring criteria included four dimensions, focus (3 points), support (3 points), organization (3 points), and content (6 points) for a total possible score of 15 points. The means, standard deviations, and range of scores are displayed in table 3.0. Again, the summary group outperformed the structured question group. The average score of the summary group ($\underline{M}$ = 9.23) is a little higher than the average score of the structured question group ($\underline{M}$ = 8.94). However, the difference is not statistically significant. The result of a one-way ANOVA showed $\underline{F}(1, 64) = .19$, $\underline{p} = .664$. With $\underline{p} > .05$, the null hypothesis could not be rejected.

Table 3.0 Mean Scores of the Evaluation Report of CPT

Measure	Group	N	M	SD	Range
Evaluation Criteria	Structured Question	34	8.94	2.69	3.00-14.50
	Summary	32	9.23	2.77	5.00-15.00
	Total	66	9.08	2.71	3.00-15.00

Discussion

The discussion will focus on the factors that might have affected the transfer tasks as a whole, since the possible reasons for a lack of statistical significance should be similar for both the near transfer task and the far transfer task.

Although there were no previous studies that directly measured the effects of structured questions on transfer tasks, many studies (Applegate, Quinn, & Applegate, 1994; Sanacore, 1984; Andre & Anderson, 1978; Kosonen & Winne, 1995; Nisbett, 1993; Perins & Grotzer, 1997) did suggest that metacognitive skills and critical thinking skills facilitate better learning. The structured questions used in this study were supposed to activate metacognitive skills and critical thinking skills. Thus, theoretically, the forced use of such skills as analyzing, synthesizing and evaluating in answering structured questions should have promoted reading comprehension and produced better understanding in applying knowledge and skills obtained through reading articles.

Contrary to what was expected by theoretical assumptions, the structured questions group did not perform any better than the summary group on both near transfer task and far transfer task. The lack of a significant effect may be due to a number of factors: failure to activate the students'metacognitive skills or critical thinking skills, the lack of student motivation to the experiment, inadequate practice for the treatment, and the unfamiliar topic area with a lot of technical jargon in the articles used for the current study.

Failure to Activate Metacognitive Skills or Critical Thinking Skills

There are several possibilities that the students failed to activate metacognitive skills or critical thinking skills. One possible explanation is that most students' answers to structured questions were about the article rather than the reflective thinking on the content of the article. The purpose of using structured questions in the current study was to force the student to apply critical thinking skills such as analyzing, synthesizing and evaluating skills to reflect on the implications of the content of the articles in their future learning or teaching. However, while answering questions like "what are your gut reactions to this article?", "what are the implications for your future teaching? and "what are the implications for your learning?", most students failed to recall details of the content of EPSS such as its components and functions, but rather focused on their general feelings. Those general feelings were emotional, and many were negative. For example, several students expressed their concerns that the computer would replace humans because of EPSS, which was not what they wanted to happen. Others complained there were too many technical terms in the articles that were difficult for them to understand at the beginning.

On the other hand, the summary group at least applied their own metacognitive strategies to summarize the main idea and its supporting ideas. The group's sole focus on the content might have helped them recall the content of articles when they were required to write the list of evaluation criteria for EPSS product evaluation.

Another possibility of the failure of skill activation is that the structured questions in this study might have been too difficult to these students. This was inferred from an analysis of the students' answers to implication questions. Most of them centered around describing the content of the articles rather than the implications for practice. If the students did not understand what inferences are, or simply did not answer the question, it is unlikely the structured questions had the desired effect.

Lack of Students' Motivation to the Experiment

Participation in reading assignment phase of this study was voluntary though the participation of transfer tasks was required. However, the participation of the study had no negative effect on students' grade. The students did not get reward for performing or not performing on the tasks. That might be the reason why only around one third of 101 students submitted their reading assignments. The completion of the reading assignment of writing summaries or answering structured questions happened outside classes. The time the students spent finishing the assignment and the efforts they made were unknown. However, by reading their answers to the questions and summaries, it was somewhat obvious that many students did not put much effort into either answering the structured questions or writing summaries. Most students answered the structured questions with only one or two sentences or even left one question unanswered. Similarly, the summaries of most students were short with one paragraph of about 130 words. This may result in low retention of the content and poor performance on near transfer task among students of both groups.

Another inference is that the students did not spend the time to learn or perform, since participation did not affect their grade. Perhaps they did not perceive the task to be worth a lot of effort. This low effort could be observed in the time spent in completing the transfer tasks. The transfer tasks were designed to be completed in about 40 to 50 minutes, but most participants in this study finished the tasks in 30 minutes or less. The expected finishing time was based on the average time the students spent in two pilot tests. The first pilot test was conducted in the same course during the previous semester. The students who attended the pilot test had similar backgrounds and the average time they spent was about 40 minutes, ranging from 30 to 50 minutes. In another pilot test done in a graduate class, the average time the students spent was about 40 minutes.

Inadequate Practice of the Treatment

The short time period for the experiment might not have provided the structured questions group with enough practice on answering structured questions. The current study asked students to read two articles on the same topic within a week. The students who participated in this study were not familiar with the structured questions format for reading. Nor did they get feedback as to the accuracy of their responses. Two trials may not be adequate for them to make use of this format. In previous applications of this format as used in Construe (Lebow, Wager, Marks, & Gilbert, 1996), students received feedback after their first application which led to better responses on the second application. As a result, perhaps, the treatment was not optimized.

Unfamiliar Topic Area of Reading Material

The participants in this study had no prior knowledge of the topic of EPSS, and they were still a bit confused after reading the articles. The two EPSS articles used in this study are conceptual and well written with simple and very concise language. However, perhaps because of their conciseness, they did not provide examples to explain where the EPSS products were being used, and what they looked like. This caused problems with understanding for some students.

The limited prior knowledge of EPSS might have hindered the students' comprehension of the articles and weakened their performance on the transfer tasks. Participants in this study were from various educational majors. The course was one of the required courses for educational major students that help them establish a foundation of knowledge in educational technology. Most participants were novice computer users. When the experiment was conducted, it was in the early weeks of the course. The students were just beginning to learn Microsoft Word, and email. They had not studied educational software evaluation which was a topic to be discussed later in the semester, and is related to EPSS product evaluation. This lack of basic knowledge about evaluation may have affected their performance on the transfer task. A large number of previous studies (Hamilton, 1997; Machiels-Bongerts, et al., 1995; Wilson & Cole, 1992; Reigeluth, 1983) have indicated that prior knowledge facilitates information processing and text recall. Without related prior knowledge, transfer might be difficult to occur. When means of both summary and structured questions group scores were examined, it is evident that the average score was very low. For the first task, the total average score was only 3.60, which was 24.0% of the possible total score. The total average score of 9.08 for the second transfer task was only 60.5% of the total points which would also be considered failing performance. One assumption of these low scores is that the acquisition of knowledge never took place. Without the retention of the learning content, learning transfer would never have been occurred.

Suggestions for Future Research

While the hypotheses were not supported, the current study provides sufficient evidence that further research should be pursued in several areas for a better understanding of the effect of structured questions on transfer tasks. These areas include:

- How to monitor or control student's efforts in answering structured questions
- How to provide feedback on the adequacy of answers to structured questions
- How to provide adequate practice to better the chance of transfer
- How to assess content acquisition before determining performance on transfer tasks

Monitor or Control Student's Efforts in Answering Structured Questions

This study did not record the time the students spent to answer the structured questions. However, the students' short answers to the questions revealed that many of the students might not engage in thinking with metacognitive skills or critical thinking skills that were expected to be activated. Without the activation of the skills, the transfer of learning barely occurred. To assure the occurrence of transfer, future research may include directions that set the minimum length of each answer to the questions, and require the answer to focus on the content. Another adjustment for the research can be to ask the students to finish the reading assignment in the class. In this way, both structured questions group and summary group will have the same amount of time to finish the assignment. The time each student spends on the reading can also be recorded and analyzed.

Provide Feedback on the Adequacy of Answers to Structured Questions

One recommendation for future research is to provide feedback or a model to students for their answers to structured questions. The feedback should be directed toward getting appropriate and accurate answers to the questions related to key ideas and implications. The results of this study suggest that many students did not make use of the structured questions format well. To make sure the students answer the questions more adequately, it may be more appropriate and effective to provide each student feedback on their answers after the first reading, and show them some good examples of answers as models. The feedback may result in better application of the structured questions format and a better chance of activation of metacognitive skills and critical thinking skills.

Extend the Duration of the Experiment

It is also recommended that the duration of the experiment be extended. The results of this study indicate that students might not get used to answering the structured questions after reading only two articles. It might show significant difference if the students are required to read two more articles for two more weeks rather than to read two articles within a week. The increased amount of practice with the structured questions format may increase the possibility of activating metacognitive skills and critical thinking skills that the students have acquired before. The skill activation may in turn generate better transfer.

Assess Content Acquisition Before Determining Performance on Transfer Tasks

It is recommended that future researchers assess content acquisition before conducting transfer tasks. A test of recall may be conducted after students finish reading articles to examine whether students acquire knowledge or not.

Future research may also select another topic other than EPSS. It is recommended that participants not be familiar with the chosen topic but are interested in it because they will put in more effort and participate in the activities more actively if they perceive something as relevant and interesting (Keller, 1983). It is also recommended that the transfer task be designed so that it can be assessed properly, if not easily.

In conclusion, this study shows that under the stated conditions both structured questions and summarizing strategies are equally effective. However, it is likely that different conditions would lead to different results. That is, modified conditions in future research such as training on the use of structured questions, a meaningful and relevant task, and motivated participants might change the outcomes of this study.

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Revisiting Research Constructs in Distance Education: Enhancing Learner Interaction to Build Online Communities of Learners

Online Moderating Techniques to Promote Asynchronous Communities of Discourse

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Abstract

An upper-level class of secondary education majors learned how to moderate online asynchronous computer conferences and each student was assigned a week to develop a topic and lead a discussion on an issue dealing with media and technology. This paper details a structure of student moderated computer conferences that can be used to instill learner autonomy, a sense of ownership of student ideas, and take advantage of the reflective nature of the media

Introduction

Few would argue that interaction is an important part of any class regardless of whether the class is face-to-face, delivered at a distance or a combination of the two. Moore defined three types of interaction found in distance learning: learner content interaction, learner instructor interaction, and learner-learner interaction. He contended that learner-learner interaction would challenge future thinking and practice but noted that its use would vary depending upon the situation, ages, experiences, and levels of autonomy of the learners (Moore, 1989). Learner-learner interaction could be employed with or without the intervention of the instructor. Harasim and Yung (1993) in discussing a survey of 176 teachers and learners on the Internet reported differences found in computer-mediated communication when compared to face-to-face instruction. They discovered that when online, learner-learner group interaction became more detailed and deeper. They also found that personal communication between learners increased. Online discussion groups enable students to develop rapport for each other (Powers & Mitchell, 1997). Ahern (1995) reported that computer conferences provide opportunities for authentic peer-interaction wherein students will develop an awareness of authorship.

This case study explores learner-learner interaction in a structured environment using aspects of trained online moderation of discussions, ownership of knowledge and learner autonomy in course mostly delivered face-to-face with online asynchronous computer conferencing conducted as an enhancement to the class serving as the majority of the class homework.

The sample

The class studied was comprised of 20 undergraduate juniors and senior in various fields of secondary education. The course was the only technology requirement in their program of study. Since this was a required course, the student's level of computer experience covered a wide range. Some students were quite comfortable with computers having grown up with them in their homes and schools. Others, especially older non-traditional students, had very little experience with computers. At the least experienced level, students did have experience with using word processing programs to write papers. Along with a wide range of computer competencies, there was just as wide a range of knowledge regarding issues of technology and education.

The structure

All students underwent a two-day moderator training. The training was based on a brief practical guide to moderating online computer conferences covering issues including, what is a computer conference moderator, preparing for the conference, welcome messages, and common problems and solutions often found in conferences. The guide has been used it for both student training and faculty development. The training also included extensive classroom discussion on dealing with the lack of non-verbal cues and finding agenda behind the words. Students were also given clear written instructions directions covering what was expected of each as a conference participant.

The course syllabus showed that computer conferencing was a large part of assessment. Moderating counted for 10% of assessment and participation counted for an additional 30%. Contracting for participation has been found to be effective. Often students feel reticent to participate in an unfamiliar activity and if they are not given incentive, they will choose not to take part in the conference or infrequently post message wanting in both quantity and quality (Eastmond, 1995; Hillman, Willis, & Gunawardena, 1994; Murphy et al., 1996). Conferencing groups need time to coalesce and if participation is not mandated, this would probably not happen. A usual case is that a conferencing system is 'made available' but no more. Invariably it does not get used.

The class was divided into two conferencing groups of ten each. These groups were maintained throughout the semester. Ten is a workable number since assuming full participation, a larger group would be hard for students to keep track of, and a smaller group would tend to make the participants feel as if they always need to be 'performing' (Cifuentes, Murphy, Segur, & Kodali, 1997). The instructor modeled the first week of conferencing. Modeling is very important since students new to computer conferencing, need to know what is expected of them with as much specificity as possible. Modeling behavior and the expected discourse are two concepts that cannot be emphasized too strongly. After the week of modeled behavior, the instructor did not participate in the conferences further. The groups knew that all messages were being read by the instructor since they were often mentioned in class, but all communication regarding conferencing from the instructor was emailed to individual moderators.

Students subscribed to the Educause listserv (http://listserv.educause.edu). This provided them with briefings on issues regarding technology and education. The information found on the listserv was often used to generate topics for online discussion. Each student moderated one week of discussion while the other nine students were participants. No topics were assigned; rather each was negotiated with the instructor. The topic came from Educause or anything of interest to the student as long as it dealt with a contentious issue of technology and education.

Welcome messages

Moderators were responsible for crafting a 'welcome message', which would start his or her week of discussion. This message usually contained a four-part structure:

1. A personable introduction
2. Presentation of information
3. A minimum of four open ended question
4. The start of the issue oriented discussion with an invitation for participation

This welcome message was emailed to the instructor on Saturday for evaluation. Suggestions were made concerned with how to approach the week and whether or not the topic would work. From these suggestions, the message was rewritten and resubmitted, sometimes a number of times, until it was approved and on Sunday, it was posted on the BlackBoard course management system in a new forum.

Minimum participant responsibilities

The class discussed what was to be considered a message of substance, and it was decided that a good message would be at least a few short paragraphs in length, but more important, it needed to advance the conversation. A message just restating a previously made point, or serving no other purpose than agreement or disagreement would not be counted.

The responsibilities required of a participant were also quite defined: There messages a week were the mandated minimum.

- The first message must be in response to the welcome message within two days after its posting.
- The second message must be in response to a participant response within next two days.
- The third message could be in response to anything previously posted, or could make a new point, but needed to be posted within the next two days.
- Further messaging was encouraged but not mandated.

Responsibilities of the moderator

The moderator was charged with keeping things going while using proper moderation techniques including:

- Promoting full participation
- Using email (cc. to the instructor) to solve problems and curtail miscommunication
- Extending the discourse
- Setting a tone of inclusion
- Restating and ask for clarification
- At the end of the week, weave a summary rich in quotation detailing the major points of the week.
- At the first class of the next week, present the welcome message and summary to the entire class

Since the two-conferencing groups were segregated, half the group did not take part in any given discussion.

Findings

The conference held for both groups the final week of the course was moderated by the instructor. The discussion was based on student impressions of moderating and participating in online discussions. What worked and what did not? Was it fun? Was it too much work? Students were asked to pose their own questions as well to the group. Some themes that emerged and seemed to strike a chord with students were, that although moderating was a time consuming, many enjoyed their moderator week more than those when they were participants. Although it was generally agreed upon that moderating was more work than being a group member, many really enjoyed the sense of ownership of an engaging discussion dealing with a topic of their own.

Nearly half of the participants posted more (often many more) message than the required three. All the students, except one who couldn't see how it could fit in a beginning math course, wrote that if the equipment were available when they teach, that they would use asynchronous conferencing in their classes.

Previous computer experience was not correlated to success using computer conferencing. This may be due to the fairly simple system provided by BlackBoard, but it may also be related to a number of comments saying that the experience is closer to writing or talking than it is to running computer programs. The class, without prompting, set a tone of supportiveness and politeness in both groups. This enabled a deeper and more reflective discourse than found in discussions where the moderator was found to be terse and confrontational. The degree of respect, friendliness, and support found in the messages just 'happened'. A space of comfort and acceptance was created in both groups.

Conclusion

Online asynchronous conferencing is a useful enhancement to face-to-face classes. It enables discussions on topics that would be able to be dealt with in as much depth given the constraints of class time. Allowing students to own their words proved quite effective and allowed engaged and vibrant discussions that might have taken on a different dimension if filtered through a figure of authority. It promotes critical thinking, as well as writing. The inherent asynchronicity allows time for reflection and results in remarkably complex and insightful discourse.

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Creating an Online Community by Using ICQ Active List

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Abstract

One of the important characteristics of the Web-based courses is that they utilize different Internet tools to close the gap between the instructor and the learner. Although many different Internet tools can be used today to close this gap, there are a number of problems with the existing tools. In this paper, we introduce ICQ Active List, which has the characteristics of many Internet tools that can be used in place of all those tools to eliminate the problems. We also touch to the issue of creating an online community, which is very important in Web-based courses, and describe the principles we followed to create such a community. Most of the principles and the experience can be used to create learning communities in Web-based courses.

Introduction

One of the most important characteristics of Web-Based Instruction (WBI) is to utilize different Internet communication tools. Since almost all of the interaction vital for WBI takes place on these tools, effective use of them is directly related to the success of the courses. There a number of Internet communication tools that can close the gap between the instructors and students of WBI. These tools are course web sites, electronic mail (e-mail), electronic mailing lists (or listservs), threaded discussion groups (or Usenet newsgroups), Internet Relay Chat (IRC or chat), Instant Messaging (IM), audio conferencing (or Internet telephony), and video conferencing (Harrison, 1997; Madjidi et. al., 1999; Pattison, 1999).

Internet Communication Tools

A course web site is a combination of web pages that can hold such course related information as course syllabus, course notes, course lectures, course resources, web links to other useful web sites on the Internet, and etc. Students access course web sites through web browsers such as Internet Explorer or Netscape Navigator.

E-mail is the most popular Internet communication tool. An e-mail client, such as Microsoft Outlook Express, Microsoft Outlook, or Netscape Messenger, is enough to use this basic communication technology. When someone sends you an e-mail, it is kept on an e-mail server. When you would like to check for your e-mail messages, you use the e-mail client software to connect to the e-mail server and retrieve your e-mail messages. For WBI, e-mail can serve such functions as the exchange of ideas, questions, and data. In addition, any kind of relevant course materials such as assignments can be attached to an e-mail message for easy submission.

An electronic mailing list makes mass distribution of an e-mail message an easy task. Instead of sending the same e-mail message to many users one by one, the message is sent to a list. Then, every member of the e-mail list receives the same message. An e-mail list is a suitable tool for WBI instructors for sending common interest items to students such as course announcements, reminders, additional web links to other useful web sites, and etc.

A treaded discussion group is a subject-related discussion in which participants post their messages in a central place. This central place could be a Bulletin Board System (BBS), Usenet newsgroup, or web forum. In this central place, users can read messages and respond to others' messages. Each new topic becomes a separate thread in the discussion. When someone reacts to someone else's message, it appears under the original one. In WBI, this structure can be used by students for topical discussion, assignment submission, social interaction, and collaborative working.

Chat provides a text-based conversation among multiple users. The text messages are seen immediately by all users. The conversation usually takes place in virtual chat rooms which reside on chat server software. Users connect to these chat servers by using a client chat software such as mIRC. Chat rooms can be used in WBI for such purposes as virtual office hour, real time discussion, real time collaboration, social interaction, and etc.

An instant messaging tool is a convenient way to see when Internet friends are online and to message them in real time. It is faster than e-mail because the technology behind IM allows the message to be pushed to the receiver in a fraction of time, which can be said almost instantly. AOL Instant Messenger, MSN Messenger Service, and Yahoo! Messenger are examples of IM client software that can be used between Internet users. IM tools can be utilized in WBI for such instructional activities as virtual office hour, real time discussion, real time collaboration, social interaction, and etc.

Audio conferencing allows two way voice communication via an Internet connection. With the help of a technology called Voice over Internet Protocol (VoIP), communication can be carried out between two different computers, between two different physical phones, or between a computer and a physical phone. In all of these methods, voice is converted to IP packets which travel through the Internet networks. Since the use of Internet is cheaper than the use of phone lines, audio conferencing is an economical solution to get WBI users together in an audio conference. In WBI, audio conferencing can be used for such purposes as virtual office hour, real time discussion, real time collaboration, social interaction, and etc.

Video conferencing requires the attachment of a small camcorder to the computer. With the help of this device a stream of audio and video can be transmitted over the Internet to the other users. The advantage of video conferencing over chat is the presence of live audio and picture of the participants of the communication. Video conferencing tools can be used in WBI for such purposes as virtual office hour, real time discussion, real time collaboration, social interaction, and etc.

Instructors and students have used these communication tools in practical WBI settings for various purposes. Branon and Essex (2001) found the reasons for using synchronous communication tools in web-based instruction environments as:

- Holding virtual office hours,
- Team decision-making,
- Brain-storming,
- Community building, and
- Dealing with technical issues.

They also stated the reasons for using asynchronous communication tools in such environments as:

- Encouraging in-depth, more thoughtful discussion,
- Communicating with temporally diverse students,
- Holding ongoing discussions where archiving is required, and
- Allowing all students to respond to a topic.

Their survey indicated that 35% of the distance educators planned to increase their use of synchronous tools, while 65% planned to increase the use of asynchronous tools. Just 5% of them planned to decrease the use of synchronous tools and only 3% planned to decrease the use of asynchronous tools. These numbers show that there will be a growing demand in the utilization of synchronous and asynchronous tools in WBI environments.

Classification of Internet Communication Tools

Since there are a number of WBI tools and technologies available, one of the most important challenge for the designers and instructors of distance courses is to identify the right tools for online learning (Levin, 1997). Dennison (2000) uses the properties of the tools to classify them into a taxonomy that shares one or more of the general properties. A taxonomy is an ordered hierarchical list. The parts of his taxonomy are:

- Number of people communicating: The communication can be individual-to-individual, individual-to-group, group-to-group, or group-to-individual.
- Real-time communication: The tools can be divided as asynchronous and asynchronous tools.
- Permanency of communication: The tools can be divided based upon whether messages on them are permanent or non-permanent.
- Automatic delivery of communication: The tools can be divided as to if the tool automatically delivers the message (pushing) or if the user must request for the message (pulling).

While the four properties above result in a possibility of 32 combinations, some of the combinations cannot have realistic tools. Dennison also stated that at the time of his writing, there were no tools for some of the combinations such as Individual-to-group, Permanent, and Push type. Example Internet communication tools for some of the categories are depicted in table 1.

Table 1. Taxonomy of Internet Communication Tools. Adapted from Dennison (2000).

Combination	Internet Tools, Dennison (2000)
Individual-to-individual, Synchronous, Permanent, Pull	CU-SeeMe
Individual-to-individual, Synchronous, Permanent, Push	Talk
Individual-to-individual, Asynchronous, Non-permanent, Pull	Voice mail
Individual-to-individual, Asynchronous, Non-permanent, Push	E-mail
Individual-to-individual, Asynchronous, Permanent, Push	E-mail
Individual-to-group, Synchronous, Permanent, Pull	IRC
Individual-to-group, Asynchronous, Non-permanent, Pull	Listservs WWW Usenet
Individual-to-group, Asynchronous, Non-permanent, Push	E-mail
Individual-to-group, Asynchronous, Permanent, Pull	Usenet
Individual-to-group, Asynchronous, Permanent, Push	E-mail
Individual-to-group, Permanent, Push	No tools in 2000

Problems with the Internet Communication Tools

In the literature, the current problems with tools that support WBI are found as (Harrison, 1997):

- Finding appropriate software for students and instructors,
- Access control to keep outsiders from disrupting class communication,
- Training students and instructors in the use of various software packages, and
- Cost of acquisition and use of appropriate tools.

This paper describes ICQ Active List (ICQ AL), an Internet tool which can support a web-based distance education community by eliminating all of the problems stated above. It also discusses its strengths and weaknesses and presents strategies for creating a community for a WBI course.

ICQ and ICQ Active List

New forms of web tools are becoming available everyday. ICQ (I Seek You) is one of them, which is an integrated set of tools that informs who is on-line at any time and enables to contact them at will. Although it debuted as an IM tool with limited capabilities, users of ICQ can chat, send instant messages, files and URL’s to others, or they just socialize with their Internet friends while connected to the Internet. All these functions are embedded into one easy to use client software.

Version 99b of ICQ client comes with a new feature, the ICQ Active List (ICQ AL). Users can create or join ICQ communities based on a common interest and easily access them from their ICQ client software. Once users join an AL, they can broadcast messages to all of the members of the list, receive events from other list members, chat in a virtual room, post and view messages in a threaded discussion group, e-mail each other and view information.

Users can also become an AL owner, which gives them total control over the AL. They can delegate authority to any member of their list. In order to run an AL, Active List server software needs to be run. As long as the AL server software is running, the AL will be accessible by all ICQ clients. Figure 1, figure 2, and figure 3 show the interfaces of ICQ AL server, ICQ AL manager and ICQ client respectively. ICQ AL and ICQ client as an Internet tool for some of the categories of Dennison’s taxonomy is shown in table 2.

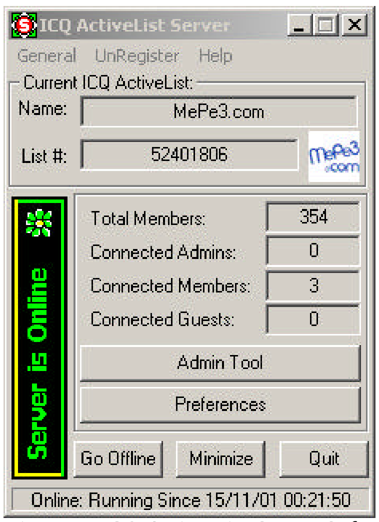

Figure 3. ICQ Active List Server Software

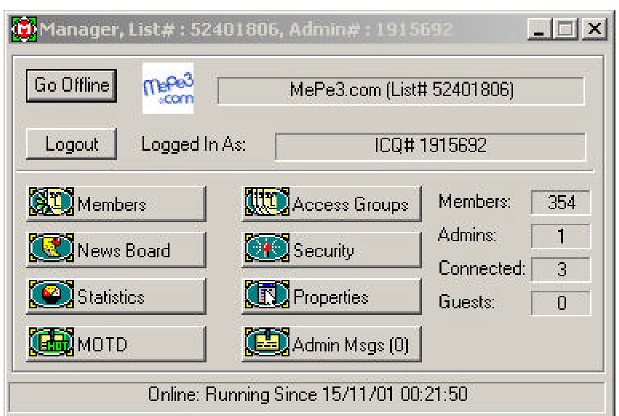

Figure 2. ICQ Active List Manager

Figure 3. ICQ Client Software

Table 2. ICQ Active List as an Internet Tool for the Different Categories of Dennison's Taxonomy.

Combination	Internet Tools
Individual-to-individual, Synchronous, Permanent, Pull	E-mail, chat, threaded discussion, instant message, audio conferencing, and video conferencing functions in ICQ AL and ICQ client
Individual-to-individual, Synchronous, Permanent, Push	
Individual-to-individual, Asynchronous, Non-permanent, Pull	
Individual-to-individual, Asynchronous, Non-permanent, Push	
Individual-to-individual, Asynchronous, Permanent, Push	
Individual-to-group, Synchronous, Permanent, Pull	
Individual-to-group, Asynchronous, Non-permanent, Pull	
Individual-to-group, Asynchronous, Non-permanent, Push	
Individual-to-group, Asynchronous, Permanent, Pull	
Individual-to-group, Asynchronous, Permanent, Push	
Individual-to-group, Permanent, Push	

Characteristics of the ICQ Active List

AL eliminates most of the problems of Internet communication tools depicted before. The most obvious advantage is that it is an appropriate tool for online communities and web-based courses. It includes many functions including e-mail, threaded discussion, chat, instant messaging, audio conferencing, and video conferencing. It even includes a very useful feature called 'Message of the Day' (MOTD) through which you can make last minute or daily announcements. You can add a button and an Internet address (URL) as part of this message. As soon as the users are connected to the AL, the message is displayed to the user. User may click the button in the MOTD at will and visit the Web page associated with the message. AL integrates all of these functions into one easy to use interface; therefore users perceive all of the functions as a whole. They do not switch from application to application to perform different tasks.

AL works on all Windows platforms including Window NT, Windows 2000, Windows 98, and Windows 95. According to information presented at the counter.com web site, these 4 windows platforms cover 93% of all users in October 2001. Therefore, most of the Internet users are able to run AL on their operating systems.

AL provides a detailed security policy in which the administrator of the AL can define security at different levels. The administrator might authorize the members of the AL or members can auto join to the AL. When authorization is required, all potential participants must ask for authorization before joining to the AL community. The administrator might or might not publish AL information and online/offline status on ICQ AL directory listing. When it is not published, Internet users will not able to see your AL in the AL directory. In case of Internet security attacks, the administrator may ban specific IP addresses, therefore not allowing access to the AL from those IP addresses. The banning may be done at the user level also. When you ban a user, he/she will not be able to access to the AL. To make handling security easier for different people in the same AL, the administrator may create groups in the AL and assign rights to these groups. These rights can be assigned in terms of broadcasting, chatting, forums, and seeing information about the AL.

Both ICQ and ICQ AL come with detailed help files. However, help function needs to be installed separately for ICQ client. AL help includes such topics as introduction to AL server, registering an AL, components of the AL, operating the AL, and configuration. In addition to the help included with the ICQ client, ICQ Web site includes an extensive online help site at the following internet address:

- http://www.icq.com/support/

AL provides detailed statistics for each of the members. It provides details on when the user joined the community, when the user last logged on, how many times the user logged on to the AL, how many messages were posted by the user to the threaded discussion group, and how many messages were broadcasted by the user to the AL group (Sending a message to the AL is called broadcasting). You can also get such server statistics as the total logon times since the server was created, the maximum number of users who got online at the same time in the AL, total number of threaded discussion group messages, the maximum number of users who used the chat, and the number of users in the chat in real time. Additional statistics included are total members of the AL, number of connected members, guests, administrators, and online users in real time. You can make an extensive analysis of the online community with the help of these data.

In any AL, administrative privileges can be shared by the owner of the AL with other members. This provides an opportunity to share the tasks related to the administration of the AL. Remote administrators can manage the AL server through their ICQ client, but before doing that the owner of the list should add these people to the administrators group.

You do not need to plan a budget for the use of this software, because both the AL server software and ICQ client are provided to the Internet community free of charge. The AL server software can be downloaded from:

- ftp://ftp.icq.com/pub/ICQ_Win95_98_NT4/ICQ2000a/ActiveList.exe

AL supports individualized messaging. Users of the AL can send a message only and only to the administrator of the group by using the 'Message Administrators' function. In this way they can ask questions about a specific issue that needs not to be known by the rest of the online community.

On the negative side is the fact that the AL server needs a continuous Internet connection to be active. The AL exists as long as the AL server software is run and connected to the Internet. If this does not happen, users will not be able to connect to the AL and the AL status will be offline to them.

Another problem might be in the support area. Since the software is offered free of charge, you can not contact the producer and request for a specific support. However, the help functions provided cover many of the issues, so this might not be a big problem.

It is not clear that the producer of the ICQ AL will continue to release new versions or the ICQ AL will be supported in the new releases of the ICQ client. However, the authors have operated an AL server for more than two years without an interruption. Besides, even if a new version of ICQ client is released which does not support AL, users may still use the old version of the ICQ client which supports AL. It was experienced that the oldest versions of the ICQ client software can still be run. The producer does not force the users to install the newest version of the ICQ client.

In terms of technical difficulties, there is a 400 member limit in the AL server. When this limit is arrived, no other people can join to the AL. The administrator should delete the non-active members to make list open to the new members. Most of the time, 400 member limit will be enough for most of the communities, especially if you are using AL for a Web-based course.

There is a policy set by the producer of the ICQ with the use of ICQ client. This policy states that ICQ service is not for use by children under 13 years of age. According to this policy, if it comes to company's attention through reliable means that a registered user is a child under 13 years of age, ICQ will cancel that user's account. Unfortunately, this may limit the creation of online communities, whose users are under the age of 13.

The Context of ICQ Active List in This Study

Kim (1998) proposed a model for creating online communities. Her model contains 9 principles, which she calls '9 Timeless Design Principles' for creating an online community. She built this model based on her experience with designing online communities for various clients. The principles in the model are helpful for addressing a number of social issues that everybody encounters when they create and administer an online community. The principals in this model are:

1. Define the purpose of the online community
2. Create distinct gathering places
3. Create member profiles
4. Promote effective leadership
5. Define a clear code of conduct
6. Organize events
7. Provide a range of roles such as visitors, new members, regular members, leaders, and etc.
8. Facilitate sub-groups
9. Integrate the online environment with the real world

Below is the description of how we applied these principles to create a sense of community.

1. Defining the Purpose of The Online Community

The purpose of an online community can be as general as bringing users together for a general discussion on a topic of interest. It can also be as specific as answering a question. In our case, we chose 'music' as a general topic. Members of the community have used the AL to discuss different genres, artists and music albums, to make comments on these, to share new services and Web sites related to the topic, and to socialize.

2. Creating Distinct Gathering Places

As soon as you run the ICQ AL server and connect it to the Internet, you have a virtual place on the Internet for your community to get together. Within the ICQ AL server itself, chat room functions as an extra unique place to gather. There is an indicator on the interface of the ICQ client, which shows the number of the people in the ICQ AL chat room. If members see any number here, they know that there are people in the chat room, and they can go there to get together. Even if there is nobody in the chat room, they may go to the chat room and wait for someone.

3. Creating Member Profiles

Every Internet user needs to create an account to use the ICQ client. During the creation of this account, the user might provide a wide range of personal information including name, nick name, e-mail addresses, postal address, gender, age, Internet homepage, occupation, position, interests, affiliations, phone numbers and a picture. Providing some or all of this information is up to the users. They may update their profile anytime by using their ICQ client. Since this profile information is provided by the members, administrators do not need to enter this information for each new member of the community. ICQ AL software associates the personal information provided by the members with the user accounts in ICQ AL server. Therefore, the administrators and other members can easily get information about the members of the community by using this feature.

4. Promoting Effective Leadership

During our experiences, it turned out that creating a community is just one side of the coin. After the creation, you need to identify strategies that will foster communication in the online community. Otherwise, the communication will not go beyond simple greeting messages. You would be even lucky if someone would respond to those greetings. Whatever tool you use, either chat, threaded discussion, or instant messaging, someone or a group of members need to take the initiative to make the communication ongoing. Kim (1998) examples this by using the land metaphor. You can purchase a piece of land, but it will not automatically turn into a nice garden. You need to know your needs, 'sow the seeds at the right time, manage the growth, defend against attacks, and be prepared to improvise'.

5. Defining a Clear Code of Conduct

Within the ICQ AL server, the properties of the AL server may be described with a short description and long description. Short description is useful for informing people in the AL directory. Long description may be used to define the code of the conduct for the community. In this area, we have defined rules to follow for the members of the community. As part of these rules, we defined actions for inappropriate behavior. For example, if a member has a bad mouth in the community, he is banned and he can not access to the community for a period of time. New rules had to be defined as the community grew and the number of interactions increased. For example, we recommended members not to accept any type of files from members that they did not know. We also made the code of conduct available on a Web site for the community.

6. Organizing Events

We organized several events in our online community. A backgammon tournament was one of them. The administrators made an analysis of available tools for this purpose. Most of the time, new tools are required to organize such events. Therefore, emphasize should be put on those tools that the members of the community will be able to use with minimum effort and resources. An innovative 3D world might sound good at first, but you need to make sure that every member of the community will have access to such a tool. It was observed that this kind of activities made the members who participated in the activities closer to each other, just like in the real world. This kind of members interacted among themselves more often and less formally.

7. Providing a Range of Roles

Some of the roles are already defined when you run your AL. These roles are administrator roles, new member roles, and guest roles. We defined regular member roles in addition to this. Administrators are responsible for the administration of the AL, like running the AL, adding and removing the members, maintaining the member database, and etc. By default, every new member of the community is assigned to new member role. This makes other members differentiate between new members and regular members. Guest role was disabled since we wanted every participant of the community to be a member of the community. Regular member role was given to those members who regularly logged on, broadcasted messages, posted messages in threaded discussion group, and participated in the chat room. Up to 4 icons can be used to differentiate the members in different roles. The function of these icons is very important. By looking at the icon of a member, another member can easily recognize the role of the other member just like identifying social status of a person by looking at him in the real world.

8. Facilitating Sub-Groups

We experienced that after a while, some of the members would like to focus on specific sub-topics of the main topic. For example, in the threaded discussion group, different threads have emerged in time. These threads included such sub-topics as the properties of a quality guitar, exchange of music hardware, comments on a particular song, and etc. We experienced that threaded discussion tool serves a good function towards this principle.

9. Integrating the Online Environment with the Real World

Since most of the members of our community are scattered around the world, it is almost impossible to get together physically with the members of the community. However, audio and video conferencing technologies may help closing the gap between the virtual world and the physical world. In today's computers nearly every computer comes with a sound card. When you have a sound card in your computer, you can use a software called NetMeeting to make voice conversation between 2 different computers connected to the Internet. ICQ client successfully integrated NetMeeting into its own structure. A member may just select another member in the list and initiate a voice conversation. Then, NetMeeting starts and the connection is established between the remote computers. In our community, we have made many successful voice conversations between different locations as far as 10000 miles from each other. Most of the time the quality and pace of the conversation was not very different from a phone conversation. NetMeeting also supports video conferencing. However, almost none of the members had a camcorder required to conduct a video conferencing.

External Evaluation

We have examined some external evaluation data related to the ICQ AL. Download.com is a Web site that distributes software. On this site, Users may also submit their opinions about various software they use by rating the features, usability, and stability of the software between bad and excellent. They may also add their additional comments. As of November 2001, 69% of the users recommended ICQ AL to be used by others (109 votes). Features, usability, and stability were all rated as 4, which meant good in the range.

Some of the users made useful qualitative comments. One of the users, who was positive, identified the software as very nice. He gave some technical information on his usage and indicated that he ran several AL servers flawlessly on a computer with a Pentium 133 MHz processor and 32 MB RAM.

Another user made a very interesting comment. He indicated that his AL server was running smoothly all the time with no problems. He commented that:

The downfall of ICQ [AL] is its best feature. It has tons of options. You just have to be smart enough to use them. If you are afraid of your programs or you don't play with them, then you will never get it right.

Discussion and Conclusions

We have used the principles identified by Kim (1998) successfully to create an online community on the Internet. This study is still in progress and every new day might result in a different experience. If you can successfully follow the 9 principles in the creation of your online community, most of the time members of your community will swing between the virtual world and the actual world just like a pendulum swinging between two different points on a continuum.

ICQ Active List is a suitable and efficient tool in creating an online community. And you can use this tool to create learning communities for your Web-based courses. However, just like any other tool, you need to use components of this tool at the right time, right place, and with appropriate strategies. Providing gathering places, defining the rules, organizing events, providing roles, and facilitating sub-groups are useful strategies that can give your online community a character. However, they are not enough to complete the recipe. If you top off these with effective leadership then you will have an effective and functional community. Our experience showed us that, most of the people in online communities are still not used to the freedom Internet has offered. They still need leaders who will guide them.

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WEB-BASED INSTRUCTION:INSTRUCTOR AND STUDENT PROBLEMS

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Abstract

In this study instructor and student problems related to the Web-Based Instruction (WBI) were identified after examining their experiences. Interviewing technique was used to collect data. Semi-structured interview questions were asked in order to identify problems related to the design, technology, support, management, student-centered learning, communication, and time from the perspectives of students and instructors. Instructors' problems were found in the area of support, communication with students, providing feedback, and handling the number of students. Students' problems were found in the area of learning new tools, communication with classmates and instructors, and social aspects of learning. Results indicated that meeting at least once face-to-face before the course and providing environment for an effective communication were important parameters for formalizing the interaction between students and instructors and also among the students. In addition to this, it is also found that fostering dialog, participation, and interaction, formative assessment of assignments, increasing students' motivation, giving importance to student differences in learning, using active learning techniques, and designing effective web sites will increase the success of the WBI.

Introduction

Using the Internet for different purposes has entered a revolution to provide better communication among people during last two decades. Especially, after the development of the hyperlink on the World Wide Web (WWW), the Internet has offered more user-friendly environments (Starr, 1997). Researchers indicated that WWW is not only a communication medium for e-mail and document distribution but it is also a place to learn (Lightfoot, 1999; Mioduser, Nachmias, Lahav, & Oren, 2000). With the combination of the specifically designed software and pedagogical knowledge, WWW can provide an educational environment that maintains the knowledge building approach to learning. These understanding, technological developments in communication and WWW have been used as new opportunities for delivering instruction online. Thus, distance learning has emerged as an approach to education in the last few years (Yellen, 1998). Especially for graduate students, universities have started to offer their courses online (Barnard, 1997; Duchastel, 1997; Kearsley, Lynch, & Wizer, 1995). These practices in new educational agenda initiated some questions on researchers' mind. They started to identify how effectively online teaching has been delivered. According to Duchastel (1997), WWW have been used mostly to support the traditional model of university instruction. This approach resulted in the loss of potential of Web tools in teaching. To use the Web effectively in instruction, instruction should be transferred to Web totally and given by using web-based teaching approaches and technologies. Moreover, Duchastel (1997) also argued that models for transferring instruction to Web have not been determined definitely.

In addition to ways of delivering instruction online, researchers have also started to investigate the characteristics of online teaching, which affect the success of distance teaching (Mclsaac, Murphy, Games, & Igoe, 1989; Pisik, 1997; & Trentin, 1997). Mclsaac, et al. (1989) reviewed 62 articles and found that researchers have carried out their studies mainly on two broad categories: instruction and administration. Under the instruction category, researchers studied learning, attitude and dropout. Under the administration category, cost-effectiveness and courseware design were investigated. According to these researchers these two main categories and subcategories are the main characteristics of online teaching. It is emphasized that these characteristics should be considered carefully during design and delivery of the online courses.

Berge (1997) explored how teachers design and deliver online instruction for adults in a post secondary school. It was found that student-centered learning, self-reflection, discussion, collaboration, authentic learning, and online discussion are the most important characteristics of the online teaching. These parameters determine the success of the online teaching. According to Sheffield (1997) learner characteristics and the instructional strategies such as selecting and sequencing events and contents are the most important parameters in online teaching. Since the learners' characteristics impact the choice of instructional strategies and the subject matter of the course, instructors need to consider the diversity among the students. As opposed to traditional classroom, online classrooms combine the students whose cultural backgrounds are very different from each other. Teaching multicultural group is an inevitable aspect of the online instruction. Even though the parameters that affect the success of online teaching have been investigated from different perspectives, teaching through online courses created different problems for students and instructors. Lui and Thompson (1999) investigated how teaching simultaneously the same course in both a distance and a traditional educational format affects instructors and what the differences are between the two teaching styles. It was found that even though the instructor prepared the same teaching materials for distance and traditional classes, preparation of distance course materials were more time consuming than traditional one. Moreover, time management, monitoring students, and e-mail communication also took most of the instructor's time to provide effective teaching to distance students. In addition to instructors' problems, researchers have investigated the students' perspectives in comparing traditional teaching and online teaching. Results indicated that there are some advantages and disadvantages of learning online. In terms of advantages, students indicated that they have wait time before answering the questions or responding to the situations. In traditional classroom they were expected to give answer right after the questions are asked. In addition, they believed that with online teaching learning goes deeper and broader. There is no time constraint. They can study 24 hours a day. In terms of disadvantages, they found that the text-based communication creates a sense of isolation, misunderstanding, suspicion, and a lack of credibility (Herman, 1999 & Mory, Gambill, & Browning, 1998). In addition to these problems, Wulf, & Schinzel (1998) investigated the effectiveness of videoconferencing, telelecture, and telelearning. It was found that videoconferencing is not sufficient in quality transmission, telelecture reduces the students' attention and interactivity, and telelearning requires new effective instructional tools. Ozden & Cagiltay (2000) found that lecturing technique should not be preferred as an instructional method in WBI.

In this study, we explored WBI problems from two different approaches that are different from the previous studies. First, in the literature, it is observed that researchers investigated instructors' and students' problems separately. Those problems mostly related to one type of Web-based course and participants explained their problems related to that course. In other words, in each study, researchers concentrated on a single Web-based course and problems associated with that course from the students' or instructors' perspectives. With this study, we aimed to identify the problems associated with different Web-based courses and from both students' and instructors' perspectives in order to provide a more detailed and two sided information. Besides, we identified that problems related with support, learning new tools, feedback, class discussions, and group projects have not been identified in detail. We considered that these are very important characteristics of WBI and should be investigated thoroughly.

Methodology

Participants

In this study, two instructors and two graduate students from a large mid-western university were interviewed. Participants from both the instructor and the student groups were selected with purposeful sampling. Since the nature of this study is qualitative, participants were selected according to their previous experience with the WBI to get deep and broad understanding about their problems related to WBI. It was required for the instructor participants to teach at least one Web-based course and it was required for the student participants to take at least one Web-based course. Instructors and students were the members of the same university, but none of the participants had a relationship through the courses.

Both of the students were graduate students. They were doctoral students in science education department. They held full-time jobs as an Assistant Instructor (AI) at the same university. Both of them were comfortable with using the computers and the Internet both in their courses and in their daily lives.

Instructor1 was a non-native speaker of English and he was an AI in the Informatics department. He taught a Web-based course three years ago. The students took this course within another country while the instructor was in US.

Instructor2 was a native speaker of English and she was a faculty in an Instructional Systems Technology (IST) department. She had already finished the first nine weeks of her Web-based course when the interview was conducted. The students who took this course were the online master students and they were seeking for a master degree through a distance master program in an IST department.

Web-Based Courses

Student1 took a Web-based course as an elective, which was given in a semester. The main objective of the course was to teach the ways of using the Internet in K-12 schools. There was one instructor teaching the course.

Student2 took a Web-based course as an elective for her major in science education department. The course was offered in six weeks during the summer session. The purpose of the course was to teach incorporating technology into the instruction. There was one instructor teaching the course.

Instructor1 taught a course in which the purpose was to teach courseware design for computer mediated learning. The course was at the graduate level and 10 students took the course. The course was offered in an instructional technology department. There was another instructor for the course.

Instructor2 taught 2 courses. One of the courses aimed to provide an introduction to the field and profession of instructional technology. The other course provided information on the instructional design process. Both courses were at the graduate level and they were part of an online master's program. The courses were offered in an instructional technology department. There were 1 instructor and 10 students in the first course, 2 instructors and 18 students in the other course.

Data Collection

Semi-structured interview questions were used to collect interview data. Interviews were conducted over a one month period. Each interview session was treated as an individually constructed discourse between the researchers and the participant. Both open ended and probing questions were used to get deep information for categories determined before the interviews. Main categories included problems related to design, technology, support, management, student-centered learning, communication, and time. In addition to these categories four open-ended questions were asked independently to compare classroom teaching and online teaching. The questions for the instructors were:

- Which one is difficult classroom teaching or online teaching?
- Do you feel like facilitator or instructor?

And the questions for the students were:

- Which one is difficult, classroom learning or online learning?
- Do you like student-centered learning?

Data Analysis

The study called for an in-depth understanding of the experiences of participants involved in WBI. Instructors' and students' data were analyzed separately from each other. All data were transcribed from audiotapes for analysis. Then, researchers struggled to understand the context, discourse, and meaning behind the participant responses to determine the main areas about which respondents have problems with WBI. It was observed that participants did not have problems about some of the pre-determined categories. New categories for instructors were determined as support, communication with students, providing feedback, and handling the number of students. New categories for students were determined as learning new tools, communication with classmates and instructors, and social aspects of learning from students' perspectives. To increase the credibility of the study, participants' responses were coded by both researchers separately. Later, common themes accepted as the new emergent categories. In addition, the data obtained from the literature was used for detailed interpretation of the results.

Findings

Interview results with students and instructors will be presented under miscellaneous categories. First, instructors' problems while teaching Web-based courses will be presented. Then students' problems will be explained in detail. Finally, we will provide instructors' and students' preference in terms of classroom instruction or WBI.

1. Instructors' Problems with WBI

Instructors' problems and difficulties will be summarized in the following categories: Support, communication with students, providing feedback, and number of students.

1.1. Support

Feeling lonely and finding support when they are in need are the biggest problems for the instructors. Since they do not know what kind of problems they will have during the course, it is difficult for them to be prepared against these problems in advance. When they have problems, instructors need two types of support: technological support and design support for the revision of the course web site. If they do not have both kind of support on time, they spend most of their time to overcome these difficulties instead of preparing themselves for future instructions. Instructor2 indicated that she was not able to have a Macintosh computer (which she was used to using) and required software at the beginning. Because of the lack of technological support, she had a lot of communication problems with the students. She had to provide feedback much later than her planned time frame. She explained the design problems as the following:

> *Instructor2: … The other big and huge problem was the sound in PowerPoint. …So, you can go through the whole week then look how to fix it. That has been very time consuming for me. Probably more time consuming than any other thing that I have done for the course. I have been doing the redesign of the web pages and then going through and editing the lessons, [and] the visual parts of the lesson.*

Learning new software also creates problems for instructors if they learn them while giving Web-based courses. They need support from the people who know these software.

> *Researcher: How about learning new software?*
>
> *Instructor2: Yes, because I had to learn Dreamweaver and I did not have the application, so I needed to track down getting the application from one of my friends. Even though the documentation was written, it was brand new program for me. Thankfully one of my friends came in, and spent about 15 minutes with me kind of showing the basics to me.*

1.2. Communication with students

Having students involved in class discussions is really important for instructors to grasp an idea about student improvement, student learning, and student problems. However, both of the instructors indicated that having students involved in class discussions is not an easy task. Since most of the students prefer to study alone, they hardly respond to class discussions. In addition to the lack of participation in class discussions, most of them also do not send any response to their instructors.

> *Instructor2: Students are very intentional about their own learning. They are doing it and I think they would like to see more of it because they are kind of doing it on their own. …In fact, there has not been very much interaction between them even though there has been a kind of mechanism for them to have some discussion. They do not respond to each other a lot. They are supposed to put these smaller type assignments up and comment on each others'. They are pretty good about putting up their own work, but only 2 or 3 students have consistently been commenting back to each other. And, many students never made any comment to anybody else. So there is not a lot of interaction going on in the course.*

Face to face communication is also necessary for WBI. Both of the instructors think that knowing students personally is important to get feedback. Talking to person without knowing puts distance between the two people. Both of the instructors felt this distance between them and their students. Instructor1 indicated that he lost one or two of the students during instruction. He believed that if he did a face-to-face talk with these students, he would be more helpful for them to solve their problems and make them believe not to drop the course. Instructor2 indicated the importance of the face-to-face interaction as:

> *Instructor2: I think one thing in distance environment that is different from our typical face-to-face courses is the informal interaction that often takes place either in the classroom or as they walk by in the hall. …So, it is like there are some interactions [in web-based courses] that are missing.*

1.3. Providing Feedback

Instructors provide feedback to students' questions and assignments. Students ask their questions basically by sending e-mails. Any given day, instructors have lots of e-mails related to students' problems. Responding to each e-mail message on time is really time consuming for instructors and sometimes it is frustrating. Instructors feel pressure to check their e-mails very often because they believe the importance of timely feedback. Instructor1 indicated that students were expecting an immediate feedback from their instructor. Otherwise, the students believe that the instructor does not give importance to their e-mails. This feeling affects the students' performance. To prevent any negative student opinions, instructor2 tries to check her e-mail every hour and try to respond to them immediately. If the questions need detailed answers and the instructor does not have enough time to write long e-mails, she prefers to send a short e-mail to confirm the reception of the message and responds in detail later. Since all of the students in instructor1's class were taking the course from a different country, he changed his daily and nightly schedule according to students' time. He did not sleep until 4 am to provide feedback.

Grading students' assignments and providing feedback are also difficult duties for the course instructors. Instructor2 explains her opinions about this issue as:

Researcher: Are you having any feedback problems?

Instructor2: Yes, just getting it done. I have a nightmare last night. I feel terrible about that. Because I feel timely feedback is important. So, not to have the feedback within reasonable time, like a week turnaround, bothers me a great deal. I literally had nightmares all last night thinking. I kept up waking up to see if I have got the feedback. So it bothers me a lot and it bothers them a lot. They keep asking "when you are gonna get things graded". So, it is definitely an issue in [Distance Education] class.

Instructor2 also indicated that she did not feel comfortable even though she graded and returned student assignments on time because she felt that some of the students were suffering from silence. She expected the students would reflect their ideas about their grades. Some of the students did so. But some of the students preferred to remain silent. She really wanted to get response from each student to make sure that they were happy with their grades.

Both of the instructors agreed that the hours spent for a three-credit course is more than a face-to-face course. Instructor2 emphasized the hard work she put with the following phrase:

Instructor2: I really do work 16 hours a day and 7 days a week and every day since school started.

1.4. Number of Students

Instructors argued that number of students is important to provide effective instruction to them. According to the instructors, 10 to 15 students is ideal class size for WBI. Instructor2 hired an additional graduate assistant to grade students' assignments on time. She felt that otherwise she would not be able to finish grading students' assignments.

2. Students' Problems with WBI

Interview results indicated that students have wide range of difficulties while taking Web-based courses. In this paper, students' problems and difficulties are summarized under the following categories: learning new tools-novelty effect, communication with classmates and instructors (class discussions, group projects, and feedback), and isolated learning.

2.1. Learning New Tools: Novelty Effect

Both of the students indicated that they had to learn new tools such as software, uploading files, chat communication through Oncourse or Sitescape, and etc. These new tools were not easy for them to learn at first when they were introduced to the online environment. Learning a new way of communication has created chaos at first, but in time students got used to it. However, learning to use new software to finish projects was really painful for students. It takes time and extra effort to learn new software. Students believe that during this process, face-to-face instruction is necessary to increase their effectiveness of doing their project. One of the students indicated that software learning was not part of the instruction. Instructor of the course expected from students to learn different software to do their assignments. However, learning new software and application of this knowledge to the assignments are not easy for a student if he/she is taking the course online. At first, students feel lonely and confused a little bit in finding resources or people who can help on that. Sending e-mail to the instructors to learn the new software is not the best solution at this point. The following part of the interview depicts the second student's problems with learning new software:

Researcher: What about software?

Student2: Yes, so I had to learn a lot of programs with that. Flash… I had to do some video editing. Dreamweaver… so I had learned them on my own. I got some help at the technology lab.

Researcher: You told that you had to learn Flash and you got help from a center. How was that help? Was it related to the course? Was it part of the course?

Student2: It was external. You are bringing up a good point; it would be more helpful if there was a help center in our faculty. They just expected us we had to learn this stuff. Not a student, but someone else told me about technology center… I still feel guilty going there. I felt bad asking them questions, because I really thought my course should have been setup to help the students. I would give my ideas.

One of the students also indicated that trying to learn new software is scary at first, even though accomplishing this task was not difficult.

Researcher: What about learning new software?

Student1: I had to learn how to use notepad to do my html. I had not used notepad before. So, I think it was assumed that everybody had used notepad before, and I was like what do I do? So I had to figure that out on my own and it turned to be really easy but it was a little scary at first, like just trying to use something for the first time.

2.2. Communication with Classmates and Instructors

Class discussions, group projects, and feedback are the main way of communication for students to share their ideas with their classmates and instructors. In this part, problems with class discussions, group projects, and feedback will be given in three different categories.

2.2.1 Class Discussions

During the class discussion, since most of the students actively participating in the discussion ask their questions at the same time, students have difficulty in following the flow of the discussion. In time, they get bored and quit writing their responses and asking questions. It is very difficult for students and instructors to create an environment helpful for their learning and teaching.

Student1: … And then when we used the live chat, which happened through Oncourse, somebody would post a comment and all of us would respond to it. But it took so much time to response to a post, in the meanwhile another response would come up, we could lose the chain of conservation because everybody was seemed to be engaged with a bunch of different conversations, it did not flow. Like, you say something, I say something, and he says something. There were all postings out of sequence. So, that was frustrating. We even talked about in the discussion like "woo I cannot track of this" you know, too many people are saying too many things at once.

In addition to this chaos, the students also indicated that time issue was problematic for the communication. Generally, since there is no meeting time for WBI like in face-to-face instruction, students study at their own pace and respond to the activities according to their available time. Some of the students prefer to study during night and some of them prefer to study during the day. These working schedules create difficulty in finding common time for class discussions. Due to these problems, some of the students prefer not to attend to class discussions. Interestingly, in this study, both of the students indicated that they did not have a computer at home. They have used the university's computers. For some class discussions, one of the students needed to go to school without considering the time.

Student1: Several students could not make the live chat sessions. We tried to schedule the live chat and it was very difficult to get a good time. We ended up making it very late; actually I had to go up to the school at night, sit around and do this thing.

Because of having difficulties in following the chat and finding a suitable time for the chat sessions, students think that class discussions are not helpful for their learning.

Student1: There really was not a lot of discussion. It almost seemed like because the discussion was so awkward and unnatural compared to just face-to-face interaction, I almost fell a desire to just do the course independently, like do it myself.

2.2.2. Group Projects

The main problem in doing group projects is to communicate effectively with the group members. Since the main communication method is e-mail, it is difficult to respond to the e-mail messages immediately after they are received. Delay in e-mail response time makes the partners frustrated and they perceive it as the waste of time. Students believe that face-to-face communication during group projects helps them to find quick solutions to their problems and ask questions and have answers directly without a delay.

Student1: … I am always checking and replying. That's [e-mail] like a primary form of communication for you. And for a lot of other classmates, it is not. It was frustrating for me to send an e-mail and not getting immediate response or at least getting a response that day. To not hear from the people for two days after I send them e-mail when I am supposed to working with them on something. So, I kind of felt like waitingggg. Hellooo. Like, answer my e-mail. So that was frustrating.

Since students do not want to take other persons' time, they try to check their e-mail more often than they do usually. Students feel pressure on themselves to check their e-mail whenever they find time and a computer. Because of this pressure, even though they do not want to think anything about the course, they force themselves to check their e-mail and respond to them accordingly. They feel like they have to work on their group members' schedule and not their own schedule. In time, the course becomes a part of their daily life.

Student2: … Just like in meeting, you have that time you know you can ask these questions, and talk about things. When you do not have these meetings the question is always going on. I do not like that as much… And you know some weekends, I do not have to think about the course but I get e-mails from people and you cannot always work the same schedule with someone else.

2.2.3. Feedback

Students usually take their feedback from instructors and classmates during courses. For WBI, students feel like responses and feedback from classmates are not as informative for them. Students have difficulty in giving credibility to classmates' opinions. Student1 indicated difficulty in trusting people if she does not know them. Because of this reason, she gave importance to instructors' feedback rather than classmates' feedback. In addition to that, student2 emphasized that most of the students did not have enough time to spend for other persons' problems. Instead, they are spending their time to find solutions to their own problems. This belief also decreases the effectiveness of the communication among the students. Students perceive the course instructor as the only resource to get information and to find answers to their questions. However, thinking like that is not the solution for students' problems. Students do not feel free to ask questions to the instructors at any time. Instructors post a time limit for students on when they should expect a response. Student2 felt herself guilty when she sent an e-mail outside of this time limit because she thought that she was taking instructor's time and disturbing him.

In face-to-face communication it is easy for instructors to follow their students' learning and provide feedback when it is necessary. In WBI, instructors can do so only if students send e-mails or responds to classroom discussion. Most of the time, this situation creates problems for doing assignments. Students want instructor feedback when they work on their assignments or projects. For WBI, students are expected to send their final version of projects. Both student1 and student2 felt that they did not get any feedback for their studies during their work. Also, their instructors did not return their final projects with the feedback. They thought that this way of grading and submission was not helpful for their learning. Since they did not know their strengths and weaknesses, they were not sure whether they were successful or not on achieving course objectives. This situation is more problematic for students who are not comfortable with asking questions to instructors to get feedback for their assignments. Sending everything on due date and having nothing but the grade makes students frustrated.

> *Student2: …because you could not ask clarification questions. We were not able to ask [like in traditional class] for her to say "oh you make sure you do this part of the assignment." It was a huge project that was hard to imagine the entire time that was involved. It would have been nice if it had little check points on the web like "oh you need to turn this part" instead of it was like everything was due at the end.*

> *Student1: I would like to get more feedback along the way I was doing my project. Like creating my web page. I would like to be able to submit it, get some feedback then go back and change it. Improve it and be graded on it. Whereas we submitted it, we read everybody's comment and got a grade. A big part of the grade was coming from this project.*

2.3. Isolated Learning

Doing collaborative work or group projects in WBI is difficult for students. Because of the difficulty in finding time for group work and giving importance to just instructors' feedback make students isolated during the course taking. The primary reason for students to take WBI is the time flexibility. They do not have to be in the classroom at certain times. So, they can take these courses when they work. This is another reason for the isolation of students from collaborative work.

> *Student1: I like to work with groups sometimes. It depends on if your schedules can match up like in face-to-face classes. With this one, I am glad that we had individual assignments versus group assignments. I think group assignments would be way too difficult to coordinate because people are online at different times. I would do my things during the week and then not online during the weekend. So, there are a lot of people doing it (classroom teachers) at the weekend. So, we always missed each other.*

In face-to-face communication students have a chance to get to know each other and to develop trust for their classmates. Student1 indicated that since she did not know the people, it was hard for her to develop trust for them. Students do not care about other students' learning, ideas, and difficulties. Their purpose is to finish the course at their own pace. They do not want anyone to disturb their comfort. Student2 said that she had a difficulty in learning different software such as Flash. However, she did not request for help from anybody in her class. She thought that everybody should have spent their time for their assignments. They did not have time to teach Flash to any other classmate. In her opinion, it was the instructor's responsibility to help students with learning new software. When she asked for help to this problem from her instructor, the instructor sent an informative web site. However, she had difficulty in finding answers to her questions. Finally, she decided to find an external support for her problems. She further indicated that too much student-centered learning makes students isolated. There should be more instruction and guidance provided by instructors. Interestingly, student2 also felt that her instructor was isolated and her teaching style was also an isolated type.

> *Researcher: Do you think it is the duty of the instructor to find solutions to your problems?*
> *Student2: Yes, what was she doing? I do not know what she did all semester. It bugged me. I did not see her taking time out to organize anything. It is obvious to me that there should have been help sessions.*

According to students, instructors are not aware of students' problems. Sometimes as the result of the student e-mails, instructors are informed about the problems. In most cases instructors send information such as a useful web site or a detailed e-mail message to help students. However, students indicate that some of the problems are difficult to solve with these information. Students still have questions in their minds and reading information through web sites or through e-mail still do not answer their questions. They need face-to-face interaction with instructors not only for asking questions but also for discussing the ideas related to their problems and for getting immediate help.

3. Responses to Open Ended Questions

At the end of each interview session, two questions were asked to identify instructor and student preferences for classroom instruction and WBI.

3.1. Which One is Difficult Classroom Teaching or Online Teaching?

There are some advantages and disadvantages for classroom and Web-based teaching. Because of this, instructors had difficulty in choosing just one type.

> *Instructor2…because it (WBI) is new and because it is unfamiliar both to instructors and learners, it is harder and more time consuming. So if someone says I could teach either way, I would probably choose the classroom, because I know how it is done, the students know how it is done. I can do it more quickly and easily. But that isn't to say that I do not think there is good place for online learning. I actually think that there is and I think it allows us just to do things and have opportunities that we could not have otherwise. But I think face-to-face is definitely easier. It is easier to prepare for; it is easier to deal with every way. The other is just more time consuming [for the instructor].*

3.2. Which One is Difficult Classroom Learning or Online Learning?

Even though student1 had positive and negative ideas about both, student2 definitely preferred the classroom teaching.

> *Student1: I think it depends on the subject matter. Our class dealt with the Internet itself. It was appropriate in a way. But I could imagine if we were doing something like teaching methods class, then it would have been ridiculous to try to do that online. I think for some courses you have to interact face-to-face with other people and actively do versus doing on your own and submitting.*

> *Student2: I think learning online is more difficult. If you are in the classroom, teacher is talking so you know what information is important or what you need to know, whereas on the web it is just like there is so much stuff that sometimes it is hard to know what is the most important thing. Are they all important?*

3.3. Do You Feel Like a Facilitator or Instructor?

Both of the instructors felt themselves as a facilitator.

3.4. Do You Like Student-Centered Learning?

Student2 indicated that student centered learning isolated students and make learning more individual. Student1 liked the individual learning since it provides her to arrange her daily schedule according to other tasks.

> *Students2: It was too student centered. I think that can be bad, really bad because it makes you isolated, you need to have a little bit more instruction, or guidance.*

Conclusions and Recommendations

In general, both students and instructors have problems on similar issues such as communication, feedback, and support. It is clear that solving problems of instructors might be helpful in solving students' problems or vice versa. For any Web-based class, face-to-face interaction should be held at least once at the beginning of the course to help instructors and students to get to know each other. Since the technology is developing very fast and making the hardware and software cheaper, Web-based video conferencing can be an option for those who cannot attend face-to-face interaction.

For instructors, technological support should be provided on time and when it is needed. Computers and software are the only way to communicate with students. If instructors have difficulty in obtaining this support on time, their communication with students can be disastrous. Students can easily drop the course just because of this.

Application of different instructional methods can be helpful for increasing students' motivation and interest toward WBI. In addition to this, spending time for preparing instructional materials by considering differences in learning style and diversity in class can make students think that their instructors are spending time for teaching the course. Since the time spent for solving course problems by instructors is invisible to students, they think that their instructors are doing nothing to help them in their learning. In face-to-face teaching, instructors give importance to apply different teaching methods according to students' difficulties. Application of the same strategy in WBI would be helpful for both instructors and students.

Formative assessment is another missing part in WBI. According to Buchanan (1999), feedback given as in the form of continuous formative assessment might help students to monitor and evaluate their progress. At the same time, this approach can help instructors to see the students' difficulties and provide immediate feedback when it is necessary. Another benefit of the formative assessment might be increasing the communication between instructor and students.

In face-to-face classroom, instructors have advantages in understanding students' difficulties while observing them in classroom. In online teaching, there is no chance for instructors to do this. However, instructors can do this observation by sending e-mails to students to learn their difficulties instead of waiting e-mails from them. Some of the students can prefer to stay silence in WBI but instructors' e-mails can make them feel that their instructors are taking care of their progress and difficulties. This approach can also be helpful in preventing student dropout.

To foster dialog, participation, and interaction, instructors need to find activities to increase students' involvement in group working and discussions.

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An Empirical Comparison Of Navigation Effect Of Pull-Down Menu Style On The World Wide Web

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Abstract

As the popularity and accessibility of the World Wide Web (Web) increases for shopping, effective navigation is becoming more and more critical to the success of E-commerce. Even though many educational technologists and Web designers have spent their energy developing effective navigation tools, it remains difficult to develop Web systems that can help customers find products or services that thy wan to purchase without experiencing disorientation problems and cognitive overload. Many E-commerce Web sites are beginning to employ a pull-down menu since it provides the most versatile navigation mechanism. Although the pull-down menu design has been used in other computer applications it is relatively new on the Web. This study analyzed the navigation effect of the pull-down menu design with three hierarchical information structures (constant, increasing, and decreasing types). The navigation effect was measured by two information searching strategies (searching and browsing) and three users attitudinal measures (appeal, perceived usability, and perceived disorientation). Three Cyber-shopping malls were developed with the pull-down menu design and three information structures. Fifty-eight undergraduate and graduate at mid-western university participated voluntarily in this study.

The findings provide useful information for designing a pull-down menu design and information structure for effective navigation. The results of this study show that there exist better combinations of pull-down menu design and information structures in terms of the efficacy of browsing, the overall appeal of the site, the perceived usability and the users perceived disorientation. The overall results showed that decreasing information structure produced more effective browsing speed, appeal, perceived usability, and disorientation than increasing information structure. This study demonstrated that the information structure that has more links on the upper levels induced more effective browsing by providing more links. Finally it is recommended that Web designers or Web researchers should consider the information structure in order to analyze the navigation effect of menu design.

Introduction

The popularity and accessibility of the Web have been increasing dramatically and changing the fundamental way to purchase products and services (Yoo & Kim, 2000). As both the amount and availability of products and services on the Web increase, effective navigation is becoming more and more critical to the success of E-commerce. However, navigating a Web site is often not an easy task, especially for novices (Berg, 1997; Dieberger, 1997; King, 1996; Sand, 1996). The potentially complex linking system and information structure awaiting Web customers can cause disorientation, increase cognitive loads (Collis, 1991), and lead to users getting lost in cyberspace (Neilsen, 1990). Hammond and Allinson (1989) contend that users may encounter a number of common problems: “They may have difficulty gaining an overview, finding specific information, or using the interface tools; they may wander without an orienting goal or strategy, or may even get lost”(p. 69).

Web customers navigate through an enormous body of information by following a likely path from one page to another until finding the product they want to buy. As the amount of products and services have been increasing dramatically, the way to organize, present, and access the products has become a crucial issue in order to support customers’ effective navigation because the complexity of navigation has increased correspondingly (Berg, 1997; Chen, Mathé, & Wolfe, 1998; Newfield, Sethi, & Ryall, 1998; Pitkow & Recker, 1994). Recent usability tests show similar evidences. Users still get lost very easily on the Web and it is still a dilemma in designing a Web site where users can find information fast and easily (Nielsen, 1997, 1999; Kim, 1995)

Such problems have prompted research on the manner in which users interact with the Web. Many researchers have studied the relationships between the user interface and information structure for effective navigation and information searching. Since the main purpose of the E-commerce Web site is to access products effectively, how the information is structured on the Web site and how the link mechanism is presented on the menu of the Web site can significantly influence the success of navigation effects (Berg, 1997; Bra, 1988; Halasz, 1988; Hardman, Bulterman, & Rossum, 1994; Shneiderman, 1998; Shneiderman & Kearsley, 1989).

E-commerce Web sites have been applied many menu designs for better navigation. Numerous Web sites began to employ a pull-down menu since it provides the most versatile path mechanism for fast navigation. The navigation effect of a pull-down menu, however, can be different depending on how information structure is organized. The information structure is invisible to users when they enter the Web site. It is the menu design that provides users with the linking mechanism. They come to understand the structure of the Web site only after interacting with menu. What users perceive from menu design may also differ depending on how information is organized. Therefore, studies investigating the effect of a menu design on the Web should be analyzed with information structure. In other words, the ideal study should be conducted in a situation which employs the menu design and information structure together to allow an analysis of how these two factors have an influence on navigation or information searching performance.

It must be emphasized that the research on navigation or information searching should consider those two factors in the same situation. This study concentrates on a pull-down menu design and information structure in the same line in order to analyze how the pull-down menu design affects information searching performance depending on different information structures.

The Navigational Structure of the Web

Navigation can be defined simply as accessing information on the Web (Gay, 1991). Navigation, however, means more than a process of simply accessing information. Cunliffe, Taylor, and Tudhope (1997) defined navigation as "…high interactivity in a structured environment with the destination seldom pre-determined. Navigation is often a compromise between user and system responsibility; an incremental process with the user making choices from directions and feedback provided by the system…" (p. 99).

A Web site is the networked body of chunks of information with links (Horney, 1993; Jonassen, 1996). The basic technique for navigating a Web site is selecting the paths provided by links (Rosenfeld & Morville, 1998). Navigation in the Web demands users engage in relatively easy activities (typing a URL, using search engines, and moving mouse and clicking links) for navigation. Information structure is how the information is organized on the Web and it provides the primary ways users can navigate through links (Rosenfeld & Morville, 1998). Since users can only create paths based on the links provided, the logical navigation underlying design of those links influences the paths that users can take. Therefore, the structuring of the information plays a fundamental role in navigation (Hardman et al., 1994).

When users enter the Web site, it is not easy to understand the entire information structure of it. Users come to understand its structure as they navigate through the paths provided by the menu design. The fundamental function of the menu is to display links on the screen so that a user can navigate through a Web site (Schwartz & Norman, 1986). A series of interactions among a user, information structure, and menu allow a user to construct a cognitive structure for navigation.

Users exchange the information and control with a given system based on two main components: menu design, which controls the communication with users through linking mechanisms, and the information structure, which relates to how to incorporate the original structure of the content into the structure of a Web site (Chang, 1995; Jul & Furnas, 1997; Marchionini, 1995; Oliveira, Goncalves, & Medeiros, 1999). Although the information structure is invisible to users, they come to understand it when they interact with menus that reflect the information structures. Clearly there are a number of ways menus and information structures vary. For instance, the same information can be structured using a different structure style. There also can be different ways to design the menu to present the same information structure. In that point, it is possible that the information searching performance can be different in situations where users interact with the same menu style that presents a different information structure.

In the research on menu design, a simple and constant information structure has been employed to analyze the effect of menu design. Most studies have investigated only constant, symmetric hierarchies in which the menus at all levels have the same number of items. However, most real-world menus are not constant but vary in the number of alternatives at each level due to the nature of the database (Norman & Chin, 1988). For these reasons, this research employed three information structures in order to examine the navigation effect of a pull-down menu.

Materials and Methods

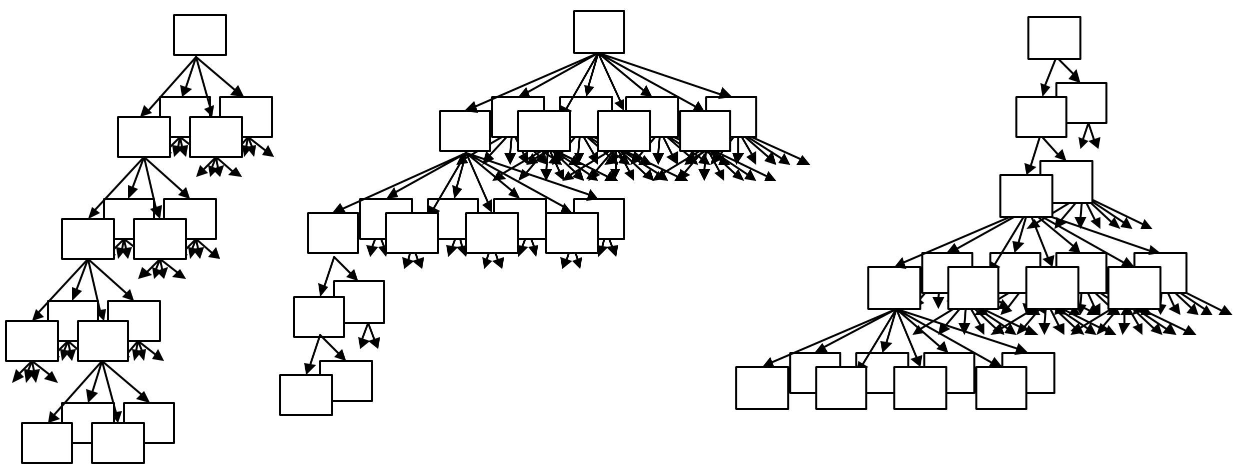
Pull-down Menu

The pull-down menu design is relatively new on the Web even though it has been used in many other computer applications. Pull-down menus appear over objects in the interface instead of in a static menu area, and they allow users to access directly the Web page they want. The advantage of this menu style is that it provides the most versatile path mechanism for navigation. Users can jump to any page by moving the mouse and clicking without through passing intermediate pages. Many Web sites for E-commerce have been adapting this menu design since users can find information fast.

Figure 4. Pull-down Menu

Information Structure

Literature in hypertext and the Web shows that the hierarchical information structure is the most popular and appropriate structure (Morris & Hinrichs; Rosenfeld & Morville, 1998). In this study, the hierarchical information structure on the Web site was organized in three ways: constant, increasing, and decreasing structure. Figure 2 shows three structures for presenting 256 items of cyber-shopping merchandise items with a depth of four levels.



Constant Structure Decreasing Structure Increasing Structure

Figure 5. Three Information Structures

Constant Hierarchical Structure

The constant structure serves as a baseline of comparison since it has been used most frequently in past research. There are four links at each level in constant hierarchical structure (4 x 4 x 4 x 4).

Decreasing Hierarchical Structure

The decreasing hierarchical structure gives a large number of choices at the top of the menu and narrows the range of choice at the bottom. In this structure, there are eight links at first and second level and two links at third and forth level (8 x 8 x 2 x 2).

Increasing Hierarchical Structure

The increasing structure gives a small number of links to the user at the top level of pages and increases the number of links at the bottom. There are two links at first and second levels and eight links at third and fourth levels (2 x 2 x 8 x 8).

Table 1 shows a summary of three Web site variants comparing the number of pages and links for each experiment. Each information structure was organized with a total of 256 pieces of information in a depth of four levels. However, the number of Web pages at each level in each information structure is different. For example, the experimental Web sites where constant information structure (4 x 4 x 4 x4) was organized with a pull-down menu designs have a total 85 numbers of Web pages. In the experimental Web sites 2, each Web site was consisted with a total number of 201 pages while experimental Web site 3 has only 39 pages in total.

Table 1. Comparison of Number of Pages and Links in Experimental Web sites

Websites	Information Structure	Number of Pages					Number of Links			
		Level					Level			
		1	2	3	4	Total	1	2	3	4
1	4×4×4×4=256	1	4	16	64	85	84	84	84	84
2	8×8×2×2=256	1	8	64	128	201	290	290	290	290
3	2×2×8×8=256	1	2	4	32	39	38	38	38	38

The most important fact in experimental systems is that the number of links is different from each other since it is determined by the shapes of information structure. For instance, the number of links at each page is 84 with constant structure, 290 with decreasing one, and 38 with increasing one when users open the all pull-down menus. The main focus of this study is how these differences caused by combination of different information structures and a pull-down menu affect users' information searching and other perception on appeal, usability, and disorientation.

Selection of Searching Task

In order to measure the influence of three different information structures on the Web site, this study included two types of tasks: searching and browsing (Canter, Rivers, & Storrs, 1985). Each five searching and browsing tasks were included in this study. The examples of each task were as follows:

- Searching task: You want to buy Epson Color 200 printer in this Web shopping mall. Please find the price of this printer in this site.

- Browsing task: Your father likes music very much and you want to buy a birthday gift for your father. Please select the music item that will make your father happy.

Participants

Total 60 undergraduate and graduate students participated at mid-western university in this study voluntarily. We excluded two subjects from final analysis because one subject had a serious sight problem due to her age and another subject missed or misunderstood several tasks due to language problem. The age of the former subject was 54years old, and the latter subject was an international student who was taking an intensive English program first level. Therefore, the actual number of subjects for the final analysis was 58. Subjects ranged in age from 20 to 49 years. They were diverse in terms of their computer and Internet related abilities.

Procedures

This experiment consisted of three sessions. During the first session, a participant was asked to fill out the background information form. It took approximately five minutes to fill out this form. After completing the questionnaire, a participant was assigned to one of three treatments randomly and was asked to find the answers of 10 tasks. Each task was given to the subject one at a time.

The subject was told to tell the researcher "start" before he/she started each searching task and to tell the researcher "the price of the item" after he/she found the answer. During information seeking tasks, the researcher measured the time for each task. This procedure continued until the subject finished all 10 tasks. It took approximately 10 to 15 minutes for a subject to finish all tasks. After completing the test session, the participant was asked to complete an attitude questionnaire. This took about 5 minutes.

Results

Information seeking performance, as mentioned earlier, was divided into two task types: searching task and browsing. ANOVA statistics showed the result of effect of searching task on time to spend finding answers among three structure designs (see Table 2). There was no significant difference among three structure designs, $F(2, 55) = .35$, $p > .05$.

Table 2. An ANOVA Summary Table With Group Means and Standard Deviations for Searching Task by Structure Design

Structure	N	M	SD
$4 \times 4 \times 4 \times 4$	19	47.22	20.08
$8 \times 8 \times 2 \times 2$	20	43.75	22.85
$2 \times 2 \times 8 \times 8$	19	50.74	32.86

Source	df	SS	MS	F
Structure	2	476.93	238.47	.35
Error	55	37171.69	675.85	
Total	57	37648.62		

Tables 3 showed that there was significant difference among three structure designs in terms of browsing task, F (2, 55) = 3.86, $p < .05$. Tukey's HSD post-hoc comparisons were used to determine significant differences between means at $p < .05$. Post hoc comparisons results revealed that there was a significant difference between increasing information structure ($2 \times 2 \times 8 \times 8$) and decreasing information structure ($8 \times 8 \times 2 \times 2$). The amount of browsing time of increasing information structure (M = 56.55, SD = 15.49) was longer than that of decreasing structure (M = 42.05, SD = 8.95), $p < .05$.

Table 3. An ANOVA Summary Table With Group Means and Standard Deviations for Browsing Task by Structure Design

Structure	N	M	SD
$4 \times 4 \times 4 \times 4$	19	47.32	22.04
$8 \times 8 \times 2 \times 2$	20	42.05	8.95
$2 \times 2 \times 8 \times 8$	19	56.55	15.49

Source	df	SS	MS	F
Structure	2	2087.76	1043.88	3.86*
Error	55	14878.72	270.52	
Total	57	16966.47		

* $p < .05$.

The following results, on the other hand, showed that there was significant difference among three structure designs with respect to three participants' perceptions: the degree of perceived appeal, usability, and disorientation.

As shown in Table 4, there was statistically significant difference in the degree of users' perceived appeal in terms of three structure designs, F (2, 55) = 4.60, $p < .05$.

Table 4. An ANOVA Summary Table With Group Means and Standard Deviations for Users' Perceived Appeal by Structure Design

Structure	N	M	SD
$4 \times 4 \times 4 \times 4$	19	17.21	4.66
$8 \times 8 \times 2 \times 2$	20	20.65	4.09
$2 \times 2 \times 8 \times 8$	19	15.63	6.80

Source	df	SS	MS	F
Structure	2	258.03	129.01	4.60*
Error	55	1544.13	28.08	
Total	57	1802.16		

* $p < .05$.

Tukey's HSD post-hoc analyses also were conducted to examine differences in users' perceived appeal among three structure designs. There was significant differences between decreasing information structure ($8 \times 8 \times 2 \times 2$) and increasing information structure ($2 \times 2 \times 8 \times 8$). That is, the degree of users' perceived appeal for decreasing information structure (M = 20.65, SD = 4.09) was higher than that of increasing information structure (M = 15.63, SD = 6.80), $p < .05$.

Table 5 showed that there was statistically significant difference in the degree of usability in terms of three structure designs, F (2, 55) = 5.61, $p < .05$.

Table 5. *An ANOVA Summary Table With Group Means and Standard Deviations for Usability by Structure Design*

Structure	N	M	SD
$4 \times 4 \times 4 \times 4$	19	15.68	1.92
$8 \times 8 \times 2 \times 2$	20	17.30	2.56
$2 \times 2 \times 8 \times 8$	19	14.00	4.28

Source	df	SS	MS	F
Structure	2	106.11	53.05	5.61*
Error	55	520.31	9.46	
Total	57	626.42		

* $p < .05$.

Post-hoc analyses showed that there was significant differences between decreasing information structure ($8 \times 8 \times 2 \times 2$) and increasing information structure ($2 \times 2 \times 8 \times 8$). The degree of usability for decreasing information structure (M = 17.30, SD = 2.56) was higher than that of increasing information structure (M = 14.00, SD = 4.28), $p < .01$.

Finally, as shown in Table 6, there was also statistically significant difference in the degree of disorientation in terms of three structure designs, $F(2, 55) = 4.35$, $p < .05$.

Table 6. *An ANOVA Summary Table With Group Means and Standard Deviations for Disorientation by Structure Design*

Structure	N	M	SD
$4 \times 4 \times 4 \times 4$	19	10.68	3.75
$8 \times 8 \times 2 \times 2$	20	8.40	3.47
$2 \times 2 \times 8 \times 8$	19	12.47	5.51

Source	df	SS	MS	F
Structure	2	162.84	81.42	4.35*
Error	55	1029.64	18.72	
Total	57	1192.48		

* $p < .05$.

Tukey's HSD post-hoc comparisons results revealed that there were significant differences between decreasing information structure ($8 \times 8 \times 2 \times 2$) and increasing information structure ($2 \times 2 \times 8 \times 8$). The degree of disorientation for decreasing information structure (M = 8.40, SD = 3.47) was lower than that of increasing information structure (M = 12.47, SD = 5.51), $p < .05$.

Discussions and Conclusions

The important outcome of the study was that the information structure had an influence on the navigation performance of the pull-down menu on the World Wide Web. Results showed that the combination of decreasing information structure and a pull-down menu resulted in faster browsing performance, higher appeal, higher usability, and lower disorientation, while performance and attitudinal assessments were worse when a pull-down menu was combined with increasing information structure.

As reviewed in the previous section, each information structure was organized with a total of 256 pieces of information in a depth of four levels. However, the number of Web pages and links at each level varies in each case. The decreasing information structure has more links than the increasing information because a decreasing information structure consists of more information on the upper level and less information on the lower level, while an increasing information structure is the reverse.

Customers who employ a browsing strategy to purchase a product or service need more information not only for narrowing down their purchasing ideas but also for navigating the E-commerce system. It is important for customers who browsing products to provide more links or selections because they can see more products without additional navigation activities. This may help customers decide the product to buy. The result of users' attitudes supports this explanation. Users perceived a Web site more appealing, more usable, and less disorientating under a decreasing information structure than an increasing information structure. Therefore, the differences in the number of links provided by information structure may have influenced the navigation effect of a pull-down menu.

This study failed to show significant differences on searching performance. There are three possible explanations for no significant differences on searching speed being found. First, the information structures may be not complex enough to detect the differences of the speed on searching performance. All three information structures were organized with 256 information in four level depths with different shapes. Even though each structure has a different number of links and of possibility of error selecting the right path, the differences among the three structures may not be complex enough to reveal the interaction with different menu designs on searching performance. Second, the level of task difficulty of directed browsing may have been too low to reveal differences among three information structures. The tasks for directed browsing were to find simple information in this study. Lai's (1994) study showed that there was no difference on the participants' searching performance when the tasks were at a low level of difficulty, regardless of the experimental treatments. This study's results are consistent with her findings.

There are several limitations to the current study. First, this study employed only three information structures for the experiment. However, there are more diverse information structures in the real Web sites. Therefore, further studies should be conducted with more diverse information structures in order to investigate the information searching performance. Second, the information structure used in this study was the hierarchical structure with four pages at each four levels. The information structures in the real Web sites are not constant but varied. The research should expand to more different types of information structure (e.g. linear, matrix, network) and different shapes of hierarchical structures with different level of depths. These differences in information structure may result different in effects of menu design. Third, the population of participants was limited to undergraduate and graduate students in a mid-western university. Most of them had the basic skills in computer and Web. Further research should expand the population of participants.

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